VOL. XVI. No. 11 NOVEMBER 1931

MECCANO MAGAZINE

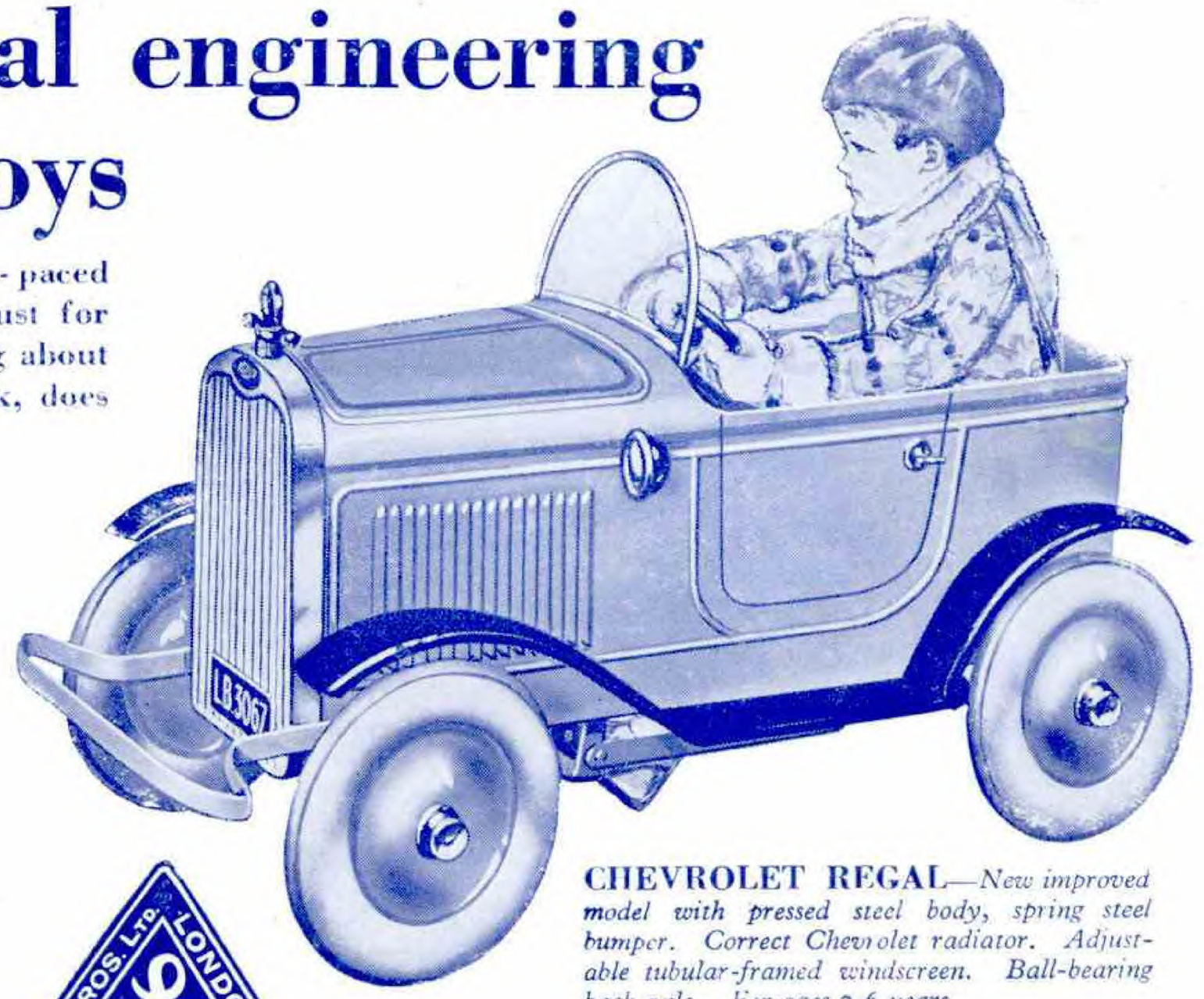


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(see page 858)

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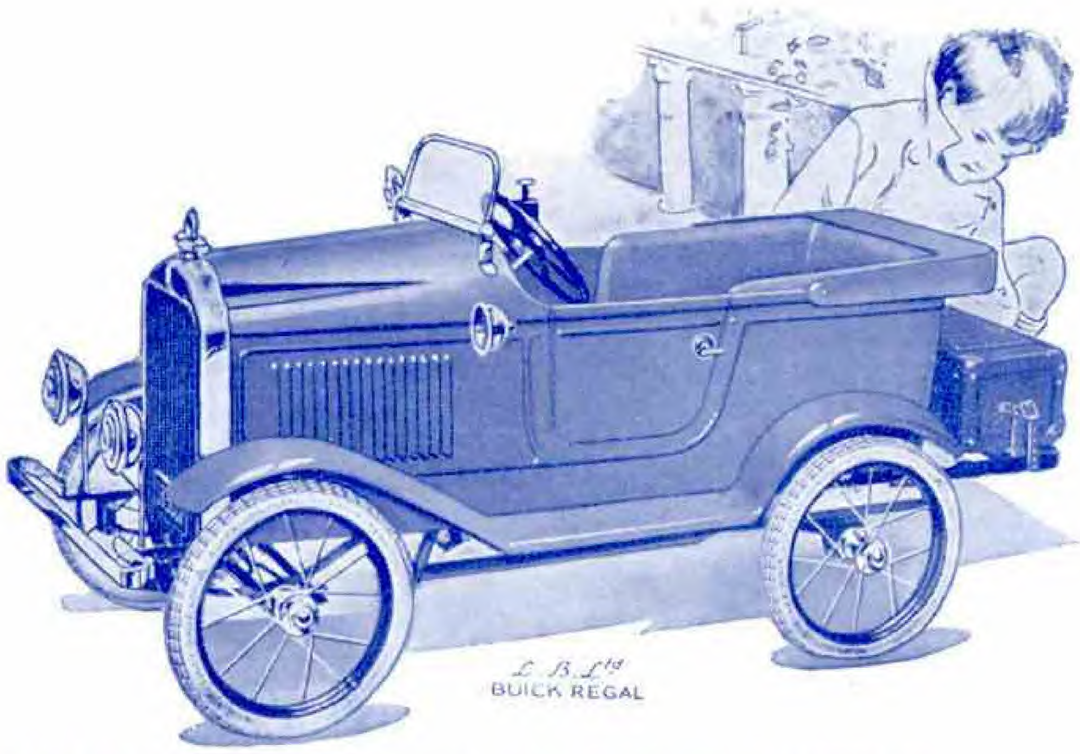


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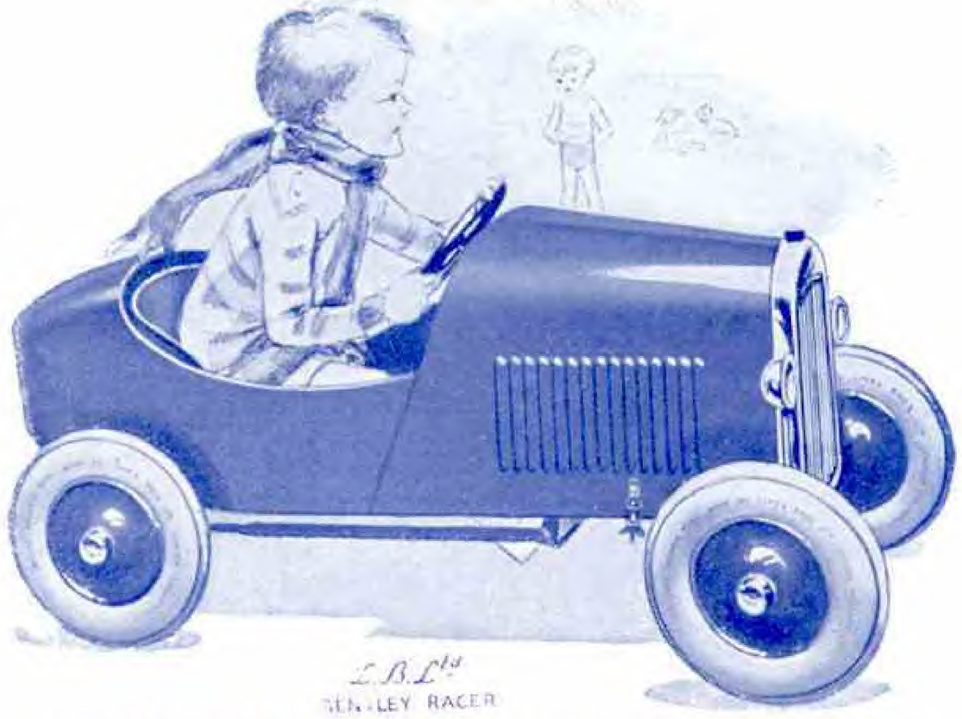
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CHEVROLET MAJOR *is longer. For ages 4-8 years.*



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BENTLEY RACER—*All steel body, lift-up bonnet. Adjustable seat. Plated model Bentley radiator. 9 in. steel balloon wheels, § in. rubber tyres. Rubber pedals. For ages 3-6 years.*

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Lines Bros. make these all-metal toys—tip lorries, wagons, vans, breakdown lorries, airplanes, doll's prams, cranes, barrows, fairycycles, Tri-ang (regd.) cycles and tricycles, scooters, pedalkars, etc., etc.

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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XVI. No. 11
November, 1931

With the Editor

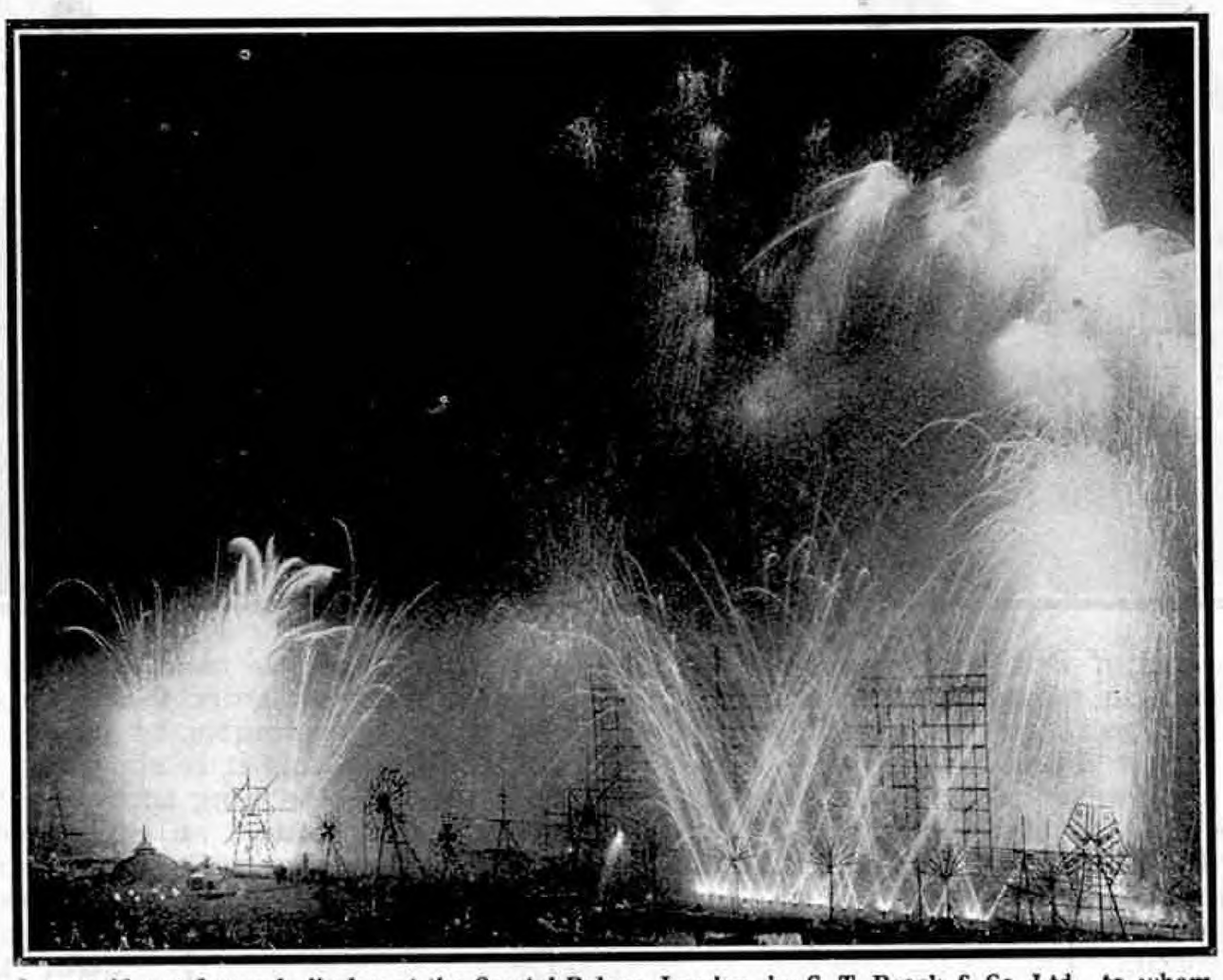
Fireworks, Past and Present

In this country fireworks are so closely associated with Guy Fawkes and his attempt to blow up the Houses of Parliament on 5th November, 1605, that we are apt to regard them as a comparatively modern development. Most people have an idea that fireworks originated from the invention of gunpowder, but this is not the case; the art of firework-making is so old that nobody knows when it began. Saltpetre and charcoal have been known from very early times, and they would provide the ingredients for a crude form of fireworks. Mr. A. St. H. Brock, who is of the eighth generation of the famous family of firework makers, tells us in his book *"Pyrotechnics"* that fireworks originated in the East, but that except in Japan they have not developed there so rapidly as in Europe. The Japanese have specialised in shells that burst into stars thrown out in symmetrical patterns and designs of extraordinary beauty. In Europe the Italians seem to have been the first nation to develop fireworks systematically.

Coming to modern times, we find that the credit for the introduction of the famous firework displays at the Crystal Palace, London, belongs to the late C. T. Brock. These displays became enormously popular. The pictorial set pieces introduced by C. T. Brock in 1875 gradually increased in size from their original diameter of 12 ft. until a plant was arrived at capable of exhibiting a picture 90 ft. in height and 200 ft. in length on the main girder. This length could be extended if required to 600 ft. of frontage for the display of such a subject as a battle piece. The smaller mechanical pieces at the Crystal Palace included between 1865 and 1910 bicycles, hansom cabs, motor cars, fire engines and aeroplanes; and in 1895 splendid full-sized representations of the *"Rocket"* and of the latest type of express locomotive were produced to celebrate the visit of the Railway Conference. The greatest display of fireworks ever given was the official peace display in Hyde Park in 1919.

A popular event in the earlier days was that of a living figure, clad in shining armour and surrounded by a frame of fireworks, sliding down a wire from the summit of one of the towers to the terrace. This performer was announced as Senor Gregorini, but in private life he was Bill Gregory! Mr. Brock tells us that on one occasion when Bill stuck half-way down and had to remain there during the rest of the display, his remarks left no doubt as to the country of his origin!

Fireworks are used for many other purposes besides amusement. At sea they are employed in great variety to provide identification signals for vessels passing Lloyd's signal stations at night. Such signals consist of hand lights, Roman candles, rockets, or Coston lights, the last-named being small hand lights arranged to burn with either one colour or two or more colours in succession. For example, the White Star burn a green light at bow and stern; the Cunard Line, off the Irish coast, burn a blue light followed by two golden star rockets; and the Ulster Steamship Company fire three vertical lights, yellow, blue and red, followed by two Roman candles fired together, each throwing two yellow, two blue and two red stars. Light signals are used also to communicate between vessels of the fishing fleets, and with the carriers; and for signals in connection with lifeboat operations. Then there is the lifeline-carrying rocket, which has resulted in the saving of thousands of lives from wrecked vessels. Other utility fireworks are the maroons that are used as warning signals, and the fog signals used on railways.



A magnificent firework display at the Crystal Palace, London, by C. T. Brock & Co. Ltd., to whom we are indebted for our photograph.

Fireworks played an important part during the Great War, and many of the most striking and valuable developments were made by Wing-Commander F. A. Brock, R.N.A.S., who was killed at Zeebrugge on 23rd April, 1918. He developed the smoke screen to a high pitch of perfection, and invented the Brock anti-Zeppelin bullet, which proved such an effective check on the Zeppelin raids. He also invented the Dover flares of one million candle power each, used by the anti-submarine patrol in the Straits of Dover, and burned to the extent of several hundreds every night. In the raid on Zeebrugge in 1918, the artificial fog screens developed by Wing-Commander Brock undoubtedly protected the approaching British vessels from the enemy's guns at a critical period of attack, and special flares that he invented also contributed largely to the success of that memorable occasion.

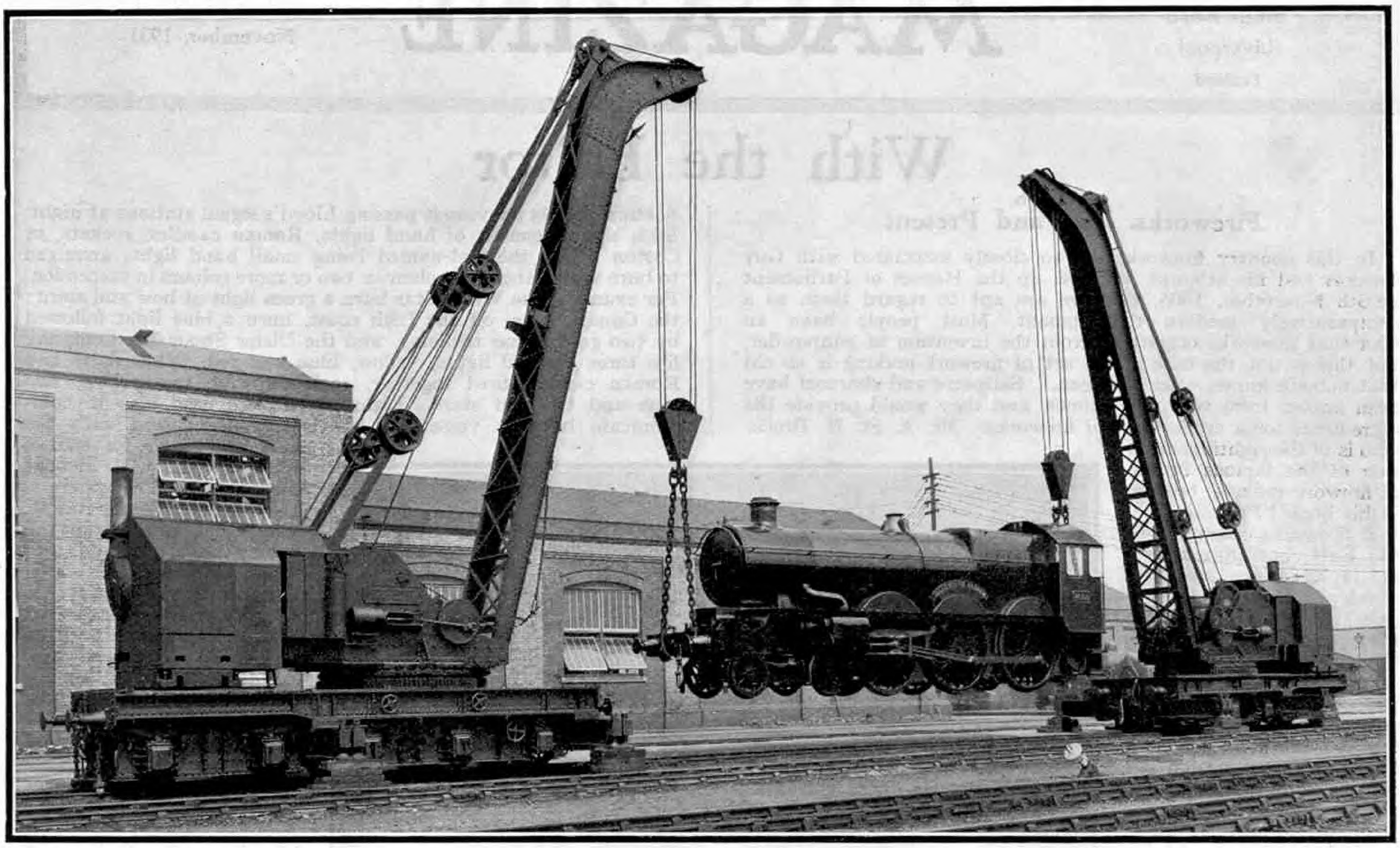
Our Special Christmas Issue

Although our Christmas issue, to be published on 1st December, will carry an increased number of pages, the price will remain at 6d. In addition to the usual popular features, this issue will include many special articles, and I am hoping to make it the best yet published—by no means an easy task!

In past years I have received complaints from disappointed readers who have been unable to obtain copies of the Christmas number. There is always a very great demand for this specially enlarged issue, and it is invariably sold out within a few days of publication in spite of the fact that a large number of extra copies are printed. Readers who wish to make sure of their copies therefore should order them now.

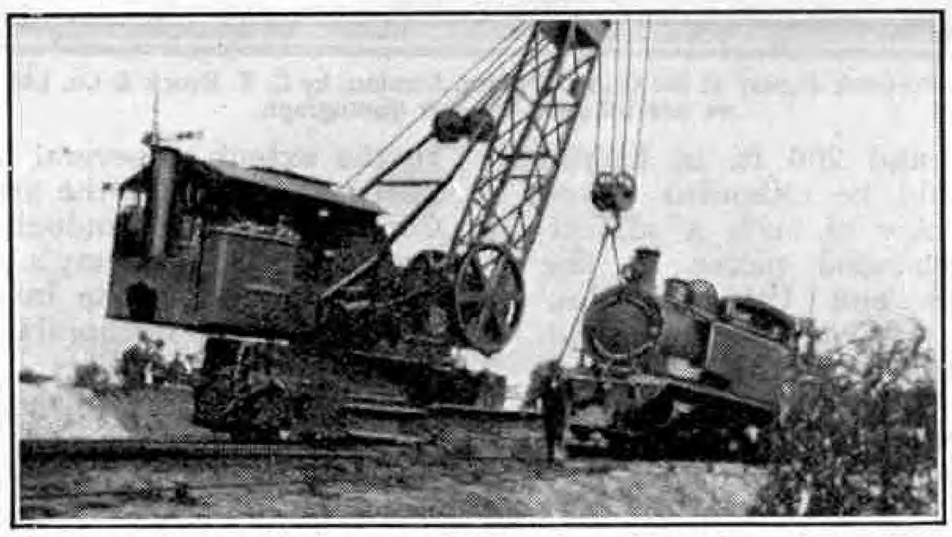
Breakdown Trains and their Work

Clearing the Permanent Way after a Mishap



ONE of the outstanding features of British railway operation is its remarkably fine record in regard to accidents. Not only is the annual total of accidents very small, but in addition most of the mishaps that do occur are of a minor character. No railway system, however perfect and carefully operated, can avoid accidents entirely, and therefore provision has to be made for dealing with them in an adequate manner.

The majority of railway mishaps consist of nothing more than the derailment of a locomotive, a coach, or a few wagons; but however trifling the accident, the engine or rolling stock concerned is out of action for the time being, and the aid of the breakdown train has to be requisitioned to clear the line and restore normal working conditions. When an accident occurs, one of the first steps taken is to report it by telegraph, or by the quickest means available, to various specified points, including the nearest locomotive depot, where a complete breakdown train is always kept in readiness to serve the whole of the district at the shortest notice. The crew of the train, known as the "breakdown gang," consists of men specially selected from among the workers at the depot, and often includes men of many different trades.



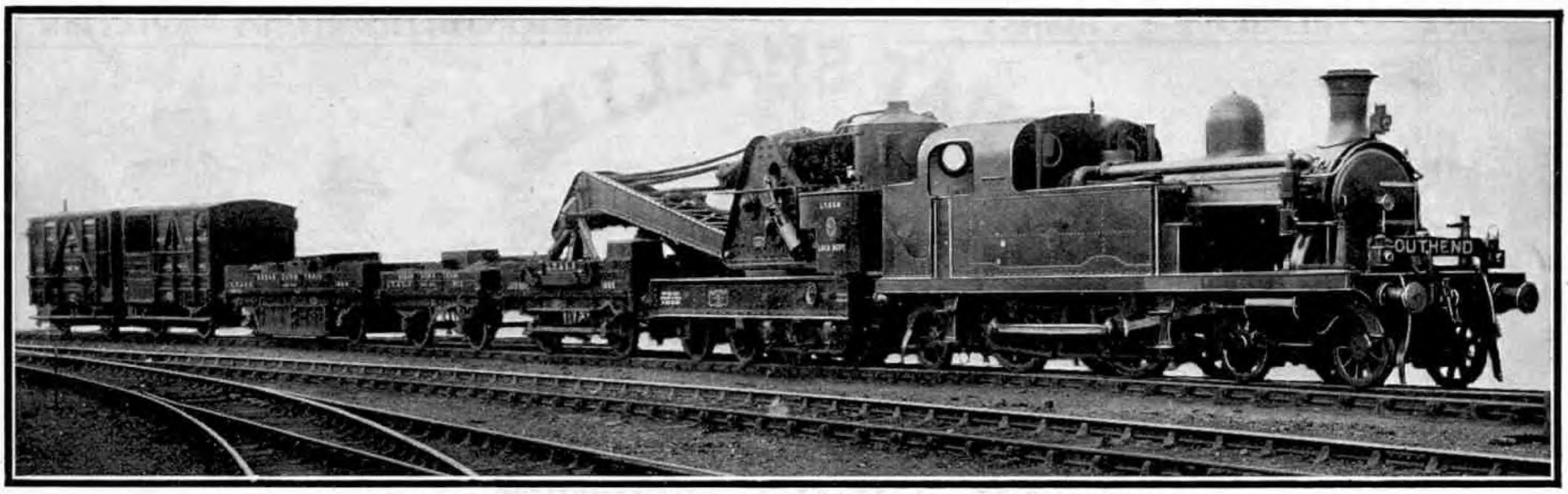
The upper photograph shows two 36-Ton Steam Breakdown Cranes lifting a "Castle" class locomotive. (Below) A large breakdown crane in action.

If the call is received during the day, the breakdown men are at once withdrawn from their work in the shops; but if the message comes at night, the running shed foreman despatches men on cycles to round up the train foreman and his gang. At busy centres the members of the crew are required to live near the depot in order that they may be available quickly at any time. The number of men in a breakdown gang varies, but at large depots it is about 16.

By the time the gang turns up at the shed, the running shed foreman has procured an engine, engine-men and a guard, and the steam crane is well fired. During ordinary working hours a breakdown train is got away in less than 20 minutes, and even at night the period required is less than an hour.

The train is signalled as an ordinary express train in order to ensure for it a clear road and to avoid any unnecessary delays; and if the call has come at night the locomotive of the train carries headlights in exactly the same formation as those of the locomotive of an express passenger train. The train's mission, however, is sufficient to secure a clear line, and special orders at the scene of the mishap allow it to proceed on the wrong road if necessary.

The composition of a breakdown train is interesting. Immediately behind the engine and tender are the travelling crane, and the "match" truck that carries a steel trestle upon which the jib or arm of the crane rests during the journey and when not in use. The jib is always lowered in this manner to prevent it from fouling overhead and wayside structures. In this position the crane is spoken of as being in running order or "running trim," and it will pass under the railway standard loading gauge of 13 ft. The "match" truck



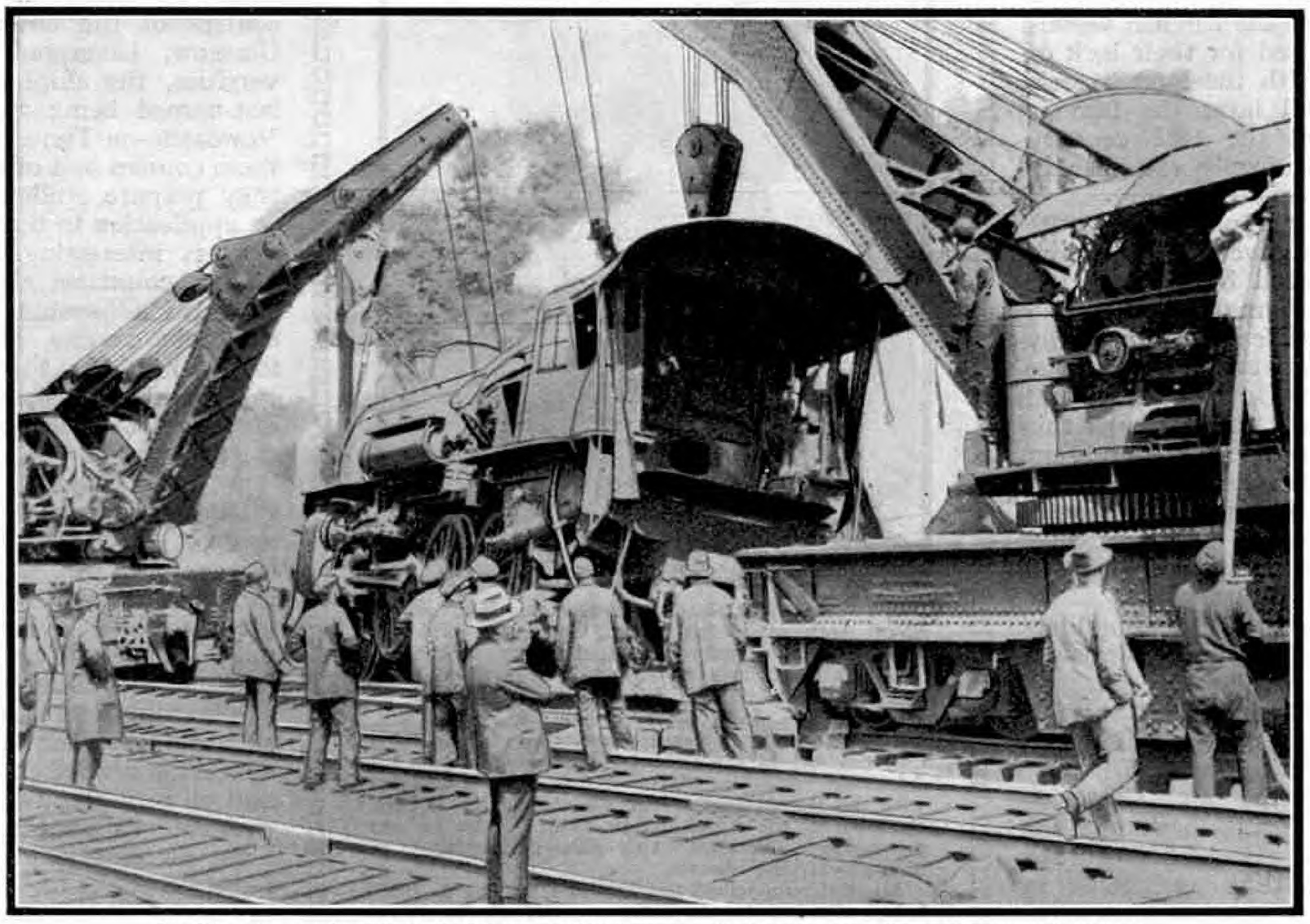
A typical breakdown train, showing the crane with its jib resting on the " match " truck.

is followed by the riding van in which the men travel; the chain van containing chains and wire ropes of every variety; and the tool van containing the miscellaneous appliances required.

The interior of the tool van reveals clearly the comprehensive nature of the work that a breakdown gang may be called upon to do. The number of articles in the van runs into several hundreds, and all are neatly and systematically stored on shelves and racks. It would take a page of the *"M.M."* to enumerate them all, but mention must be made of the powerful jacks, capable of lifting as much as 30 tons; the screw jacks, crowbars, shovels, ropes, pulleys, blocks, and various tools for relaying torn tracks. In addition there are numerous hammers, wrenches, files and a vice, and planks of various sizes and shapes known to the gang as " wood packing." There are also oil flares and acetylene lamps, detonators, flags, ambulance equipment, and a supply of cups, coffee, condensed milk and biscuits for the gang.

On arrival of the breakdown train at the scene of the accident no time is lost in getting to work. If the mishap is nothing more serious than the derailment of a locomotive or vehicle, the breakdown gang may succeed in re-railing it by means of a ramp, a sloping appliance constructed so that it fits the sleeper at one end and the rail at the other. Chains are attached to the derailed locomotive or vehicle and it is then hauled up the ramp, which guides the wheels back on to the rails. If the derailment is a very bad one, however, it is a job for the breakdown crane. Every mishap has its own peculiarities of circumstance, and personal judgment on the part of the foreman of the gang plays a large part in organising systematic clearance operations. He must decide quickly on the line of action and the manner in which the debris should be removed, so that perfect conditions can be restored with the minimum of delay.

The wreckage after an accident of any magnitude presents a wild scene, as suggested by our cover picture. Everywhere lie fragments of timbers from coaches either torn to matchwood or telescoped one into another. The locomotive, completely off the road, may be lying upon its side with wheels wrenched off, frames twisted in amazing fashion, and other parts torn and distorted, a mangled mass enveloped in escaping steam.



A mishap on an American Railroad. Lifting the derailed locomotive of the Western Night Mail.

The clearing away of the debris and the restoration of the permanent way, which often suffers severely in an accident, involves a variety of operations by the breakdown gang. In these the all-important crane is well to the fore, although its use often has to be preceded by much patient hacking and sawing to separate the shattered vehicles. This is especially the case when the impact of a collision has been unusually severe and coaches have been telescoped.

The piled-up debris is attacked at the point where it can be most easily disentangled. Long chains are hooked to the topmost vehicles and these are hauled down, a risky operation, for often the piled-up coaches or wagons lie at a dangerous angle. The crane then draws near, lifts each vehicle bodily, and carefully deposits it clear of the track. Considering the weight of modern locomotives and rolling stock it is not surprising that many modern breakdown cranes are capable of lifting loads of from 35 tons to 80 tons. The larger types of cranes are provided with special equipment so that they can lift heavy loads without damaging the permanent way. A brief description of this equipment is given on page 899 of this issue. During hoisting operations the highest point of the crane jib may be more than 25 ft. above the level of the rails.

Electrically-operated breakdown cranes are coming into greater use, and a remarkable petrol - electric double-ended crane of this type has been built by the Industrial Brownhoist Corporation, Cleveland, America. The crane is designed to work in tunnels, where clearance is very limited. There are three independent power units, two consisting of 225 h.p. petrol engines coupled direct to 400-volt D.C. generators, and the third of a 208-cell storage battery that can be used if required to supply the motors controlling the crane movements. Any one of the units is sufficient to run the crane. Electric motors are fitted for travelling, and the crane can attain a speed of approximately 33 miles per hour.

Under the skilful and experienced direction of the foreman the breakdown gang make good progress. As the debris is cleared and the damaged permanent way becomes accessible, special men get busy straightening the twisted rails where possible and replacing any that are too badly twisted or are (*Continued on page 892*)



XXV.—A NAVAL ARCHITECT

NAVAL architecture is the science of designing and constructing ships—a science that has long been regarded as one in which the British are pre-eminent. The sea has always exercised the greatest fascination for the youth of Britain, and throughout our long history there have been few periods in which interest in naval matters has declined. This preoccupation with the sea has naturally involved the building of ships, and British shipbuilders have been famous in every branch of this great industry for more than a thousand years. The "long ships" of our Saxon and Danish predecessors were famous for their speed and seaworthiness. In the struggles with Spain in Elizabethan times the sailing qualities of the English vessels more than compensated for their lack of size in comparison with the huge vessels of the Armadas, and later the famous sailing battleships of the 18th century were instrumental in firmly establishing British sea power.

During the 19th century there were many changes. Sail gave way to steam, and wood was replaced by steel as the chief constructional material. British shipbuilders took the lead in practically every important movement, and the development of the British Navy and Merchant Service kept the yards of this country working at top speed. At present shipbuilding all over the world is depressed, but it will recover, and when it does, there is no reason to doubt that British shipbuilders again will take a leading place in the industry.

The fact that British shipbuilders have lost none of their centuries-old skill is shown by the "*Empress of Britain*" recently built on the Clyde for the Canadian Pacific Steamship Company, which can safely challenge comparison with any ship that floats. In the same Clydeside yard there is now being built for the Cunard Company a vessel that will be larger and speedier than any other in the world.

Few careers are more interesting than those connected with shipbuilding, and those who enter the profession now should find excellent opportunities when the trade revival comes. A point that must not be overlooked is that shipbuilding is essential to this country, and therefore must continue to be one of our staple industries.

Formerly it was regarded as sufficient to enter upon an apprenticeship to a shipbuilding firm, and undoubtedly this is the best means of acquiring the necessary practical experience. The engineering and other scientific principles underlying the art of shipbuilding must be thoroughly understood by those who wish to become naval architects in the fullest sense of the word, however, and for this reason the modern plan is to combine apprenticeship with theoretical instruction at a University or Technical College.

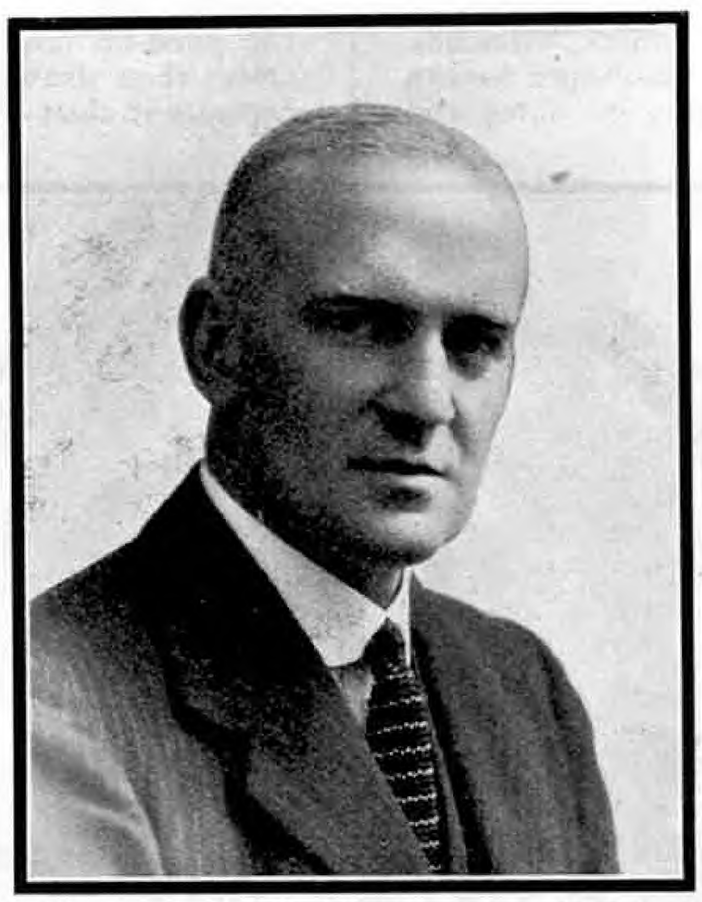
In view of the fact that a complete grasp of the principles of shipbuilding must be attained, those who intend to take up the profession should take care to include courses in mathematics, mechanics and physics in their preliminary education. These subjects should be taken in the matriculation examination, which may be regarded as the preliminary to entry upon definite apprenticeship. Then practical training begins, and this is carried on side by side with theoretical instruction by means of what is described as a "sandwich" system. In this alternate periods, usually of six months each, are spent in the shipyards and at a University or Technical College. Suitable courses are available at institutions connected with the great shipbuilding centres of the country. These include Glasgow, Liverpool and Durham Universities, the shipbuilding school of the last-named being at Armstrong College, Newcastle-on-Tyne. Full details of these courses and of the degrees for which they prepare students may be obtained on application to the respective registrars.

It is interesting to note that many foreign countries also have adopted the "sandwich" system. They have modelled their courses of training on those followed in Great Britain, and in many cases British instructors and professors of naval architecture have assisted in starting them.

A word may be said here in regard to the manner in which apprenticeship is secured. For this purpose it usually is necessary to obtain an introduction to a firm of shipbuilders, for the number of opportunities is limited. If an introduction cannot be obtained, the only recourse is to make application to various shipbuilding companies. Those applying should give full particulars of their education and of any other qualifications, and on receiving replies, efforts may then be made to come to terms with a good firm, preferably one with an established reputation. A premium may be required, but as in other professions and industries the custom of demanding fees of this ind is dying out.

The usual period of apprenticeship is five years. Small wages are paid, the amount in the first year being from 5/- to 10/- per week, rising annually by small increments. All apprentices are required to attend classes in naval architecture in order to obtain the necessary theoretical knowledge of their profession. This is not difficult in the case of those who are following a "sandwich" course, for they follow a regular scheme of studies, and at the conclusion of their stay at the University or Technical College take examinations that qualify them for a degree in naval architecture. Other apprentices must take full advantage of evening classes arranged at the technical institutions that are to be found in practically all shipbuilding centres. These give apprentices the necessary training and enable them to take the recognised

An Eminent Naval Architect



Mr. George Mc. L. Paterson, B.A., M.I.N.A., is Naval Architect to the Cunard Company. He was educated at Cheltenham College, afterwards proceeding to Pembroke College, Cambridge, where he took his B.A. in the Mechanical Science Tripos. In 1912 he joined Messrs. John Brown & Co. Ltd., Clydebank, working in various technical departments, including that devoted to experimental tank design, and the Admiralty drawing office. He became associated with the Department of the Director of Naval Construction at the Admiralty in 1915. There he was principally concerned with the development of aircraft-carrying vessels.

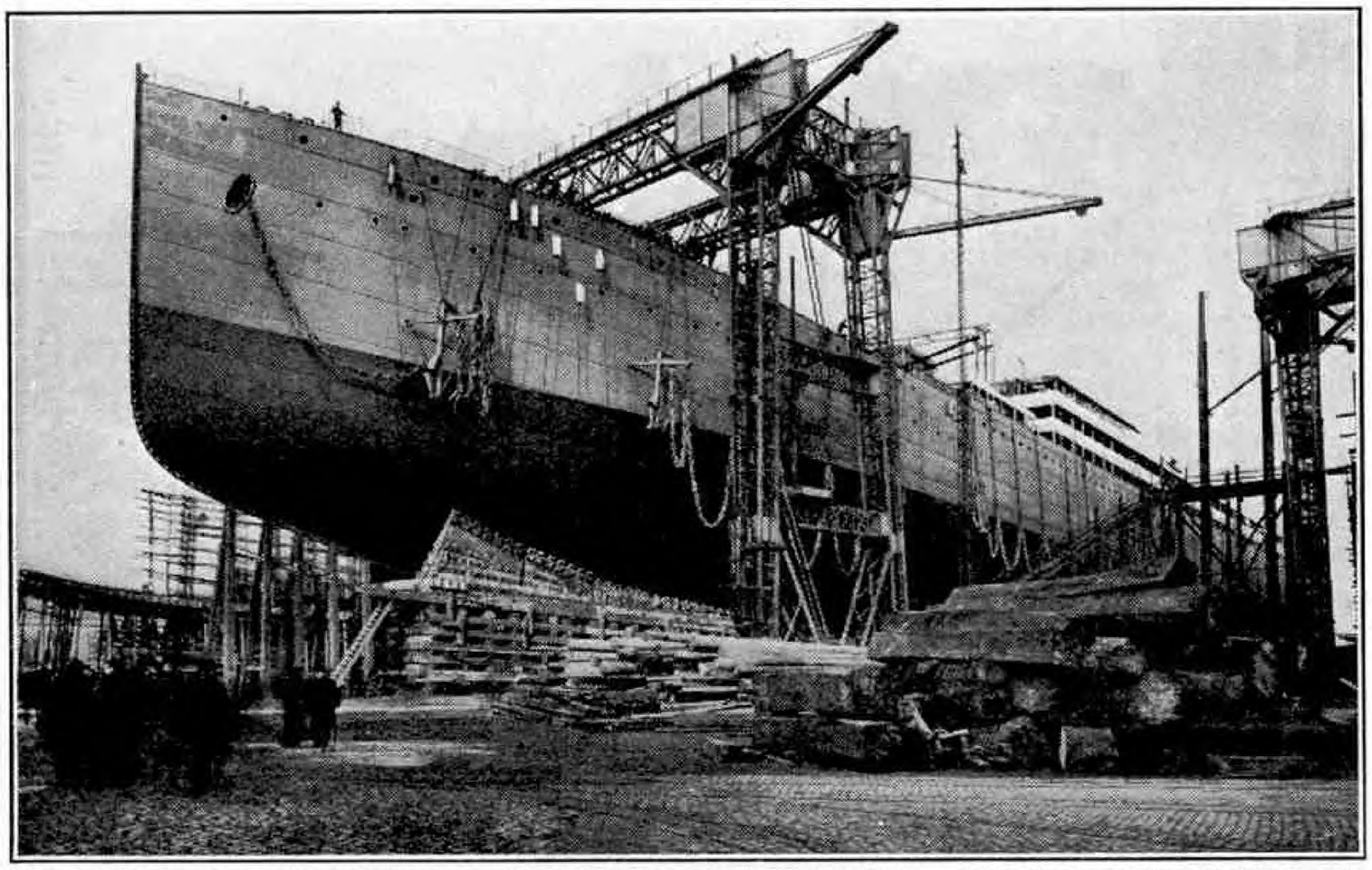
Mr. Paterson joined the Cunard Company in 1919, being attached to the technical side of the Naval Architect's Department. He was closely concerned with the development of the Cunard post-war shipbuilding programme, and in 1924 was appointed to the position of Naval Architect to the Cunard Company. He was elected a Member of the Institute of Naval Architects in 1923.

examinations in naval architecture and allied subjects set by Government departments and other authorities.

During the years of apprenticeship students should join the Institution of Naval Architects. This Institution was founded in 1860, and since then has laboured ceaselessly to promote the development of naval architecture on its practical and scientific sides, and generally to foster the interests of those engaged in the profession. Full membership is attainable only by those who are fully trained naval architects, and have been engaged in the practice of the profession for some time. A special class of membership is available to students, however, and entry into this is a great advantage. The class consists almost entirely of apprentices or students in shipbuilding or marine engineering. Students may attend meetings of the Institution, and thus be brought into contact with the most recent developments. There is no entrance fee and the present rate of subscription is 15/– per annum. The age limits are from 18 to 25 years, and on completing studentship, application may be made for Associate Membership, which in time leads to full membership of the Institution.

An exceedingly useful feature of the work carried out is the offer of a number of scholarships. Full details of these and of the work of the Institution generally may be obtained from the Secretary, Institution of Naval Architects, 2, Adam St., Adelphi Terrace, London, W.C.2.

The usual aim of apprentices to the profession of naval architecture is to enter the employ of a shipbuilding firm. They may occupy positions as draughtsmen and designers, and eventually may become assistant managers and managers of shipyards. In this, as in all other professions, advancement depends on ability. The higher posts are well paid, and a keen and resourceful young man should eventually be able to secure a good post. There is another side to the picture, however. The shipbuilding industry is severely hit when trade conditions are unfavourable, and as we have already pointed out, is now suffering from depression. Employment in the service of a shipbuilding company therefore carries with it risk of lack of opportunities.



The "Adriatic," one of the giant liners of the White Star Line, on the stocks. This great vessel of 24,541 tons is now plying between Liverpool and New York (via Queenstown).

Those who do not wish to enter the employ of a private company may take up posts such as that of surveyor to a shipping company. They also have the qualifications looked for by insurance companies and societies engaged in the general regulation of shipping. Employment of this kind is more certain in character, and for this reason is attractive to many naval architects.

A special branch of naval architecture is the building of warships, and naturally the Government is greatly interested in the education of the men who form the Royal Corps of Naval Constructors, the body responsible for the design of these vessels. The Corps is really a body of civilians employed by the Board of the Admiralty and given temporary naval rank when they are serving afloat. Their work is highly technical, and in addition to designing new warships and superintending their construction the members of the Corps are responsible for the maintenance of the existing ships of the fleet.

Recruitment of the Corps is made from two sources—the ranks of the dockyard apprentices, and candidates from outside shipyards. As a rule about two or three constructor cadetships are offered each year ; of these one is generally reserved for external students. Dockyard apprentices are boys who at the age of 15 have secured their positions through competitive examinations held by the Admiralty. They are trained in the various trades required in naval construction, and shipwright apprentices who have shown marked ability are selected to become probationary assistant constructors in the Royal Corps of Naval Constructors. They undergo a thorough course of training at the Royal Naval College, Greenwich, which is of an advanced theoretical nature, and includes the preparation of a complete working design. It is supplemented by practical training in a dockyard during the college vacation. This is obtained partly in the mould loft, where the lines of vessels to be constructed are laid down ; in the drawing office, and in actual work on vessels being constructed or in need of repair. Satisfactory work ends in promotion to the rank of assistant constructor, and shortly after a year is spent on one of H.M. ships, when experience under Naval conditions is gained. Most of the posts in the Corps have been filled by men who have started their careers as dockyard apprentices.

Entrance to the Royal Corps of Naval Constructors may be secured also by candidates who have had no connection with the Royal Dockyards. Those who wish to join the Corps in this manner must not be more than 26 years of age. They are required to submit their names to the Secretary of the Admiralty, together with full details of their training and practical experience ; and then undergo a competitive examination. The successful candidates are given a course of training extending over three years at the Royal Naval College. The appointments secured at the end of their course depend on their progress. Those who obtain a first or second-class certificate join the Corps, and appointments in the dockyards are usually given to those who secure a third-class certificate. An interesting feature is that accepted candidates who have secured degrees with honours in naval architecture at certain Universities are excused the first year of the course. All candidates accepted are paid during their stay at The Royal Naval College, and it is interesting to note that they wear naval uniform.

It may be pointed out that the Royal Naval College also affords the private student an opportunity of gaining the necessary theoretical knowledge of naval architecture. A three year's course is open to approved private students, although this may be reduced to two years in the cases of those who have obtained degrees with honours. Fees are payable by private students who reside outside the college, and they have no claim to enter the Royal Corps of Naval Constructors at the end of their course of training at Greenwich.

Those who wish to enter the Royal Naval College as private students should make application to the Secretary of the Admiralty, Whitehall, not later than the end of April in each year. An introduction from a shipbuilding establishment is required. This should state the length of time during which the applicant has been employed, in addition to recommending him as of good character and a diligent worker. An entrance examination must then be passed. In certain cases, part of this may be dispensed with, but candidates must satisfy the Director of Naval Construction that they possess a good knowledge of shipbuilding.

It must be emphasised that those who wish to make their mark in the shipbuilding profession must give their whole minds to their work during training. Shipbuilding may be regarded as a highly specialised branch of engineering, and one of the obstacles to complete success in it is lack of sufficient scientific and engineering resources. In particular a sound knowledge of mathematics is essential.

Those who are keenly interested in the scientific side of naval architecture may find research work attractive. The importance of practical and theoretical work of this kind is becoming recognised more and more every year, and the Institution of Naval Architects particularly realises its value. When a large vessel is now being planned, experiments are made in specially-designed tanks in order to ensure its safety at sea, and to make certain that the resistance to its passage through the water shall be as low as possible. Tanks in which work of this kind is carried out have been installed in various shipbuilding centres, and the design of ships of all kinds has been greatly influenced by studying the behaviour in them of scale models. The necessary preparation for taking part in research work of this character involves deep study of all sides of naval architecture.

The Great Earthquake in New Zealand

An Eye-Witness's Graphic Story

By V. May Cottrell

THE morning of 3rd February, 1931, dawned bright and fair, with nothing to indicate the imminence of the terrible disaster that so soon was to overtake Hawkes Bay. The sun shone brilliantly out of a cloudless blue sky, its fierce rays tempered to a pleasant warmth by a light breeze blowing in from the sparkling waters of the Pacific Ocean. It was just one of the typically beautiful days for which Napier is famous. All was calm until 10.45 a.m. Then, without the slightest warning, a huge subterranean upheaval occurred some 10 miles out at sea, which raised the level of the land in varying degrees throughout a wide area, and shook the town and country with fearful violence.



Rescue party of marines from H.M.S. "Veronica" landed at Napier after the earthquake.

Within half-a-minute the whole business section of the town was reduced to a tangled mass of ruins, hundreds of people being killed and many more injured. It was only a matter of minutes before fires sprang up simultaneously in various places, and these, uncontrollable in the absence of water owing to damaged mains, swept the modern portion of the town from end to end, thus completing the havoc wrought by the earthquake and bringing ruin to the majority of the townspeople. The swift onrush of the fire made rescue work difficult and dangerous, and in most cases rendered it impossible to save stock, valuable documents, cash, or personal belongings. Some unfortunates who entered wrecked business premises for this purpose were never seen alive again. The terror of that awful day and night, during which the earth rocked and trembled almost continuously, can only be realised by those who passed through it. Families were in many cases widely scattered, some being at business, some at school, and others at home or elsewhere; and the consequent fear and anxiety concerning each other's safety may be imagined.



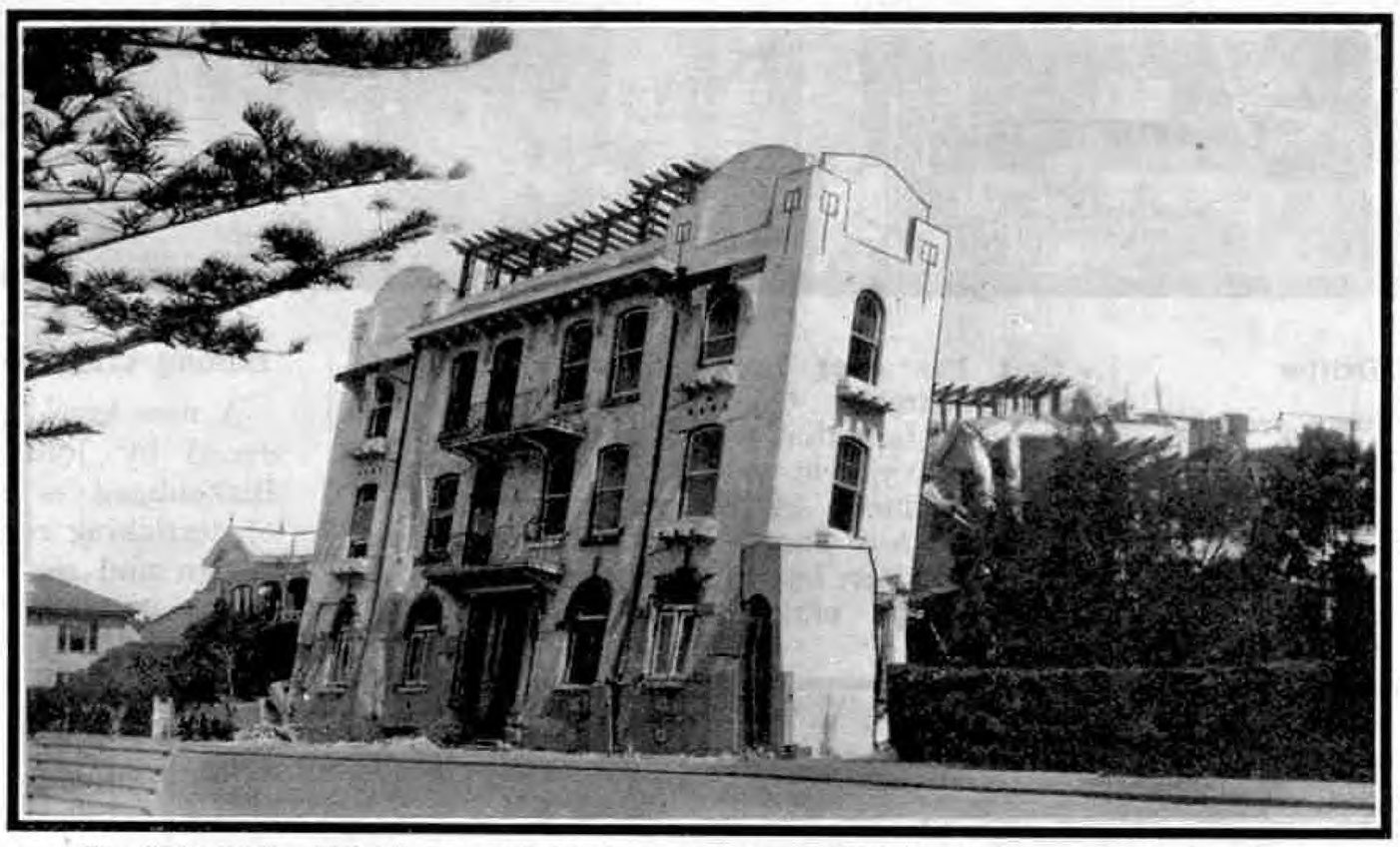
Hastings Street, Napier, during the raging fire that followed he earthquake.

In Napier the violence of the first two shocks was such that people were flung in all directions. Huge solid-looking buildings crumpled up immediately like houses of cards, and in many places the ground was torn open, leaving great gaping fissures in roads and fields. In parts of the town it will be years before the drainage can be properly restored, on account of the changed levels due to the rise in the land surface during the upheaval. It has been stated that the whole of the stricken area was actually pushed upward, by the immense pressure from below, to heights varying from 12 to 16 ft. and that these settled later, leaving the levels ranging from 4 ft. to 6 ft. higher than before. The swift upward thrust of the apparently solid earth, which was such an amazing feature of the whole earthquake, could be distinctly felt at the beginning of the upheaval, giving one the sensation of going up in a lift.

The houses in Napier are usually built of wood, with corrugated iron roofs and brick chimneys, although there is always a fair sprinkling of brick and stucco buildings roofed with either tiles or slates. The first terrific shock reduced most of the brick houses to a jumbled mass of loose bricks and broken masonry, with their roofs resting on the ground. The wooden houses rocked and creaked and strained to a terrifying

extent, and were almost all wrenched apart, receiving varying degrees of structural damage ranging from slight displacement on the foundations to complete collapse. In one terrace alone 14 out of 15 houses were wrecked and their inmates rendered homeless. It is estimated that about 7,000 houses throughout the district were damaged extensively. The contents of the houses were flung about in all directions, everything in the crockery line being smashed, while heavy pieces of furniture were tossed about like toys.

Fortunately the primary school children were out at play at all the main schools, so that there were only one or two minor injuries among a total of 2,100 children. Two of the large primary schools were built of brick, and were so badly damaged that they have since been demolished and are now being replaced by wooden buildings. The High School scholars, both boys and girls, escaped serious injury, as did those at private and other schools. The Technical College, a two-storey brick building, collapsed, however, and 20 children were caught by the falling roof, one girl and eight boys losing their lives. Some of the others were seriously injured, and a few emerged unhurt after being entombed among the debris for two days and a night. A sad feature of this occurrence is the fact that all the boys escaped from the building in safety during the first shock, but in attempting to rescue some girls in the top storey, eight brave lads were killed when the building crashed as a result of the second violent shock.



The front of Dr. Moore's Hospital, Napier, cracked and tilted bodily backward by the shocks.

The Nurses' Home, a fine five-storey brick structure, crashed without a moment's warning, killing many of the sleeping night nurses and severely injuring others. All the hospital wards and the administration offices were wrecked, adding their quota of killed and injured, and necessitating their demolition later and the erection of temporary buildings.



The utter ruin of the Napier Nurses' Home, a five-storey brick structure, in which many nurses were killed or injured.

Squads of marines from H.M.S. "*Veronica*," which was anchored at the port, landed immediately after the earthquake, and did magnificent service in rescuing victims from debris. Doctors, nurses, Red Cross workers and private citizens toiled ceaselessly, in spite of their own private tragedies and losses, in order that lives might be saved and suffering relieved. Adequate supplies of drugs were brought in by aeroplane shortly after the disaster. The failure of the town's water supply and electric light rendered work at the dressing stations extremely difficult, but flares and tanks of water were quickly forthcoming. All telegraph and telephone communication was cut off, and the local wireless apparatus was put out of action. The wireless installations on H.M.S. "*Veronica*" and on two merchant ships lying in the bay were still intact, however, and thus news of Napier's plight was flashed abroad.

Doctors, nurses, voluntary workers, provisions, tents, bedding and medical supplies came in from other towns as fast as speeding motor cars could bring them. Fortunately the main south road was not seriously damaged. There were wide cracks and dangerous subsidences in many places, but these were quickly filled in by large gangs of roadmen. For several days the railway was impassable for a distance of about 40 miles out from the town. The rails were twisted in a truly remarkable manner. In some places they resembled snake coils, and in others they were suspended in mid-air owing to subsidences.

The most astonishing feature of the earthquake was its effect upon the sea, the waters of the Inner Harbour, and several salt water lagoons near by. When the land was pushed bodily upward, the sea receded for a considerable distance, leaving much wider beaches throughout the whole Hawkes Bay coastline. The lagoons were automatically drained, while in the Inner Harbour, a large land-locked arm of the sea, the water disappeared completely from a large area, leaving hundreds of acres of dry land. There are now only unsightly mud flats where pleasure launches and yachts used to skim over the sparkling water, and it is now possible to walk dry-shod for miles where formerly the water flowed to a depth of from 4 ft. to 6 ft.

In the space available here it is not possible to tell the story of the clearing of the wreckage, the return of the inhabitants, the erection of temporary shops and offices, and the progress that has already been made in the rebuilding of the city. It is a thrilling and inspiring story of pluck and indomitable spirit.



An Interesting Motor Drifter

The "*Efficient*," a drifter recently launched from the Fraserburgh yard of Messrs. J. & G. Forbes, is claimed to be the best equipped vessel of this type yet built. She is 80 ft. in overall length and has a beam of 18 ft. 9 in. Her Diesel engine develops 160 h.p. and gives the vessel a maximum speed of 11 knots, while her cruising speed is 10½ knots. A unique feature is that the machinery of the drifter has been so greatly simplified in design that a qualified engineer is not required, an ordinary member of the crew being capable of taking charge of the engine after receiving brief instructions.

Motor Vessel with Two Stroke Engine

The "*Kalundborg*," a new motor vessel that has been put into service between Kalundborg and Aarhus by the Danish State Railways, is the first Diesel-engined vessel to be employed on the route. Her propelling machinery is of special interest, for it is the first Burmeister & Wain single-acting, two-stroke cycle, airless injection marine Diesel engine of the trunk-piston type.

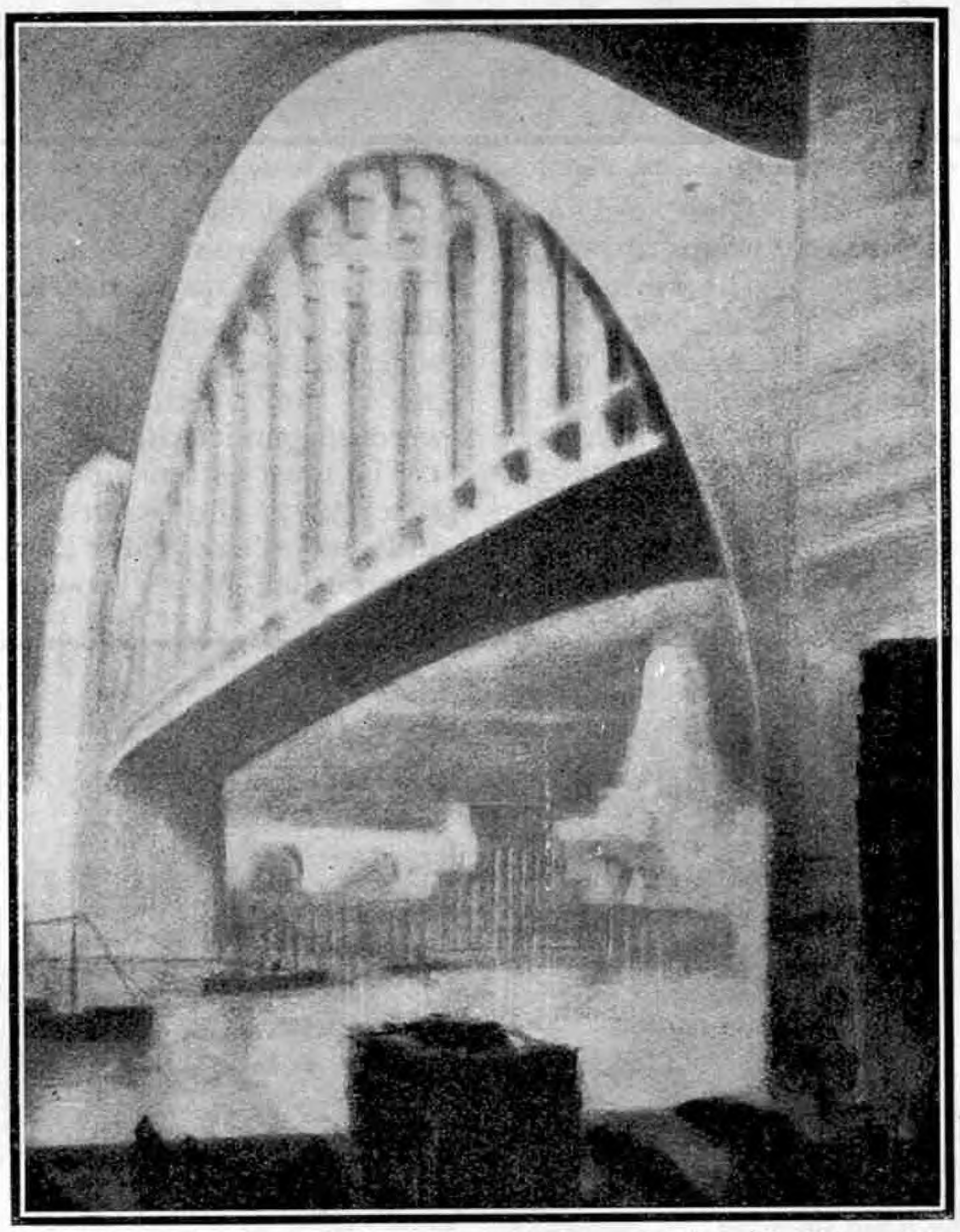
The vessel is 272 ft. in overall length. She has accommodation for 1,200 passengers, and one deck is devoted to the carriage of motor cars and cargo. The engine has six cylinders and develops 2,850 i.h.p. at 160 r.p.m. giving a service speed of 15 knots. It is interesting to note that the auxiliary machinery includes electrical generators that also are driven by Diesel engines of the single-acting, two-stroke cycle, airless injection type. There are three of these engines and each develops 82 b.h.p. at 285 r.p.m.

Large Scale Blasting at Penmaenmawr

30,000 tons of rock were completely broken up at Penmaenmawr Granite Quarry recently by a single charge consisting of 30 cwt. of gelignite. The charge was placed in T-shaped headings on the south side of the Penmaenmawr Mountain at a height of about 1,500 ft. above sea level and the roar of the explosion was heard for many miles.

The explosion was one of the biggest that has ever been attempted at the Penmaenmawr Quarries, the section of the rock face that was blasted away being about 100 yds. in width and 65 ft. in depth. The engineer in charge of operations pegged white flags to mark the boundary of the section before the circuit firing the charge was closed. Some idea of the exactitude with which the calculations had been made may be gained from the fact that the boundaries marked were correct to within a foot. A crowd of about 200 people watched the record blast being made from a distance of 500 yds.

When the rock had subsided in a heap at the foot of the quarry new plant specially designed for dealing with large quantities of material was employed to clear the rock away.



A reader's drawing showing his impression of a great arch bridge of the future. The material used throughout is concrete.

Luffing Crane Without Derricking Ropes

A new level luffing electric crane introduced by John H. Wilson & Co. Ltd., Birkenhead, is remarkable for the absence of derricking ropes, a plan that simplifies design and reduces cost of upkeep. The crane is constructed to lift a load of 1½ tons at a radius of 35 ft. A separate electric motor is fitted to provide each of the four motions, these being lifting, revolving, le el luffing and travelling. The brakes of the motors are of the magnetic type.

The superstructure of the crane is of steel construction and is strongly braced. It revolves on a ring of live rollers that work between machined paths on the superstructure itself and on the top of the gantry. The gantry also is constructed of strongly braced steel sections and plates.

Steel Band of Record Length

What is claimed to be a record steel band was rolled a short time ago at the Sandkirk Steel Works, Sweden. The band was 360 ft. in length, .0472 in. in thickness and 32 in. in width, and was eight inches wider than any previously rolled. It is interesting to note that the Sandkirk Steel Works possesses machinery capable of rolling steel strip only .0001182 in. in thickness.

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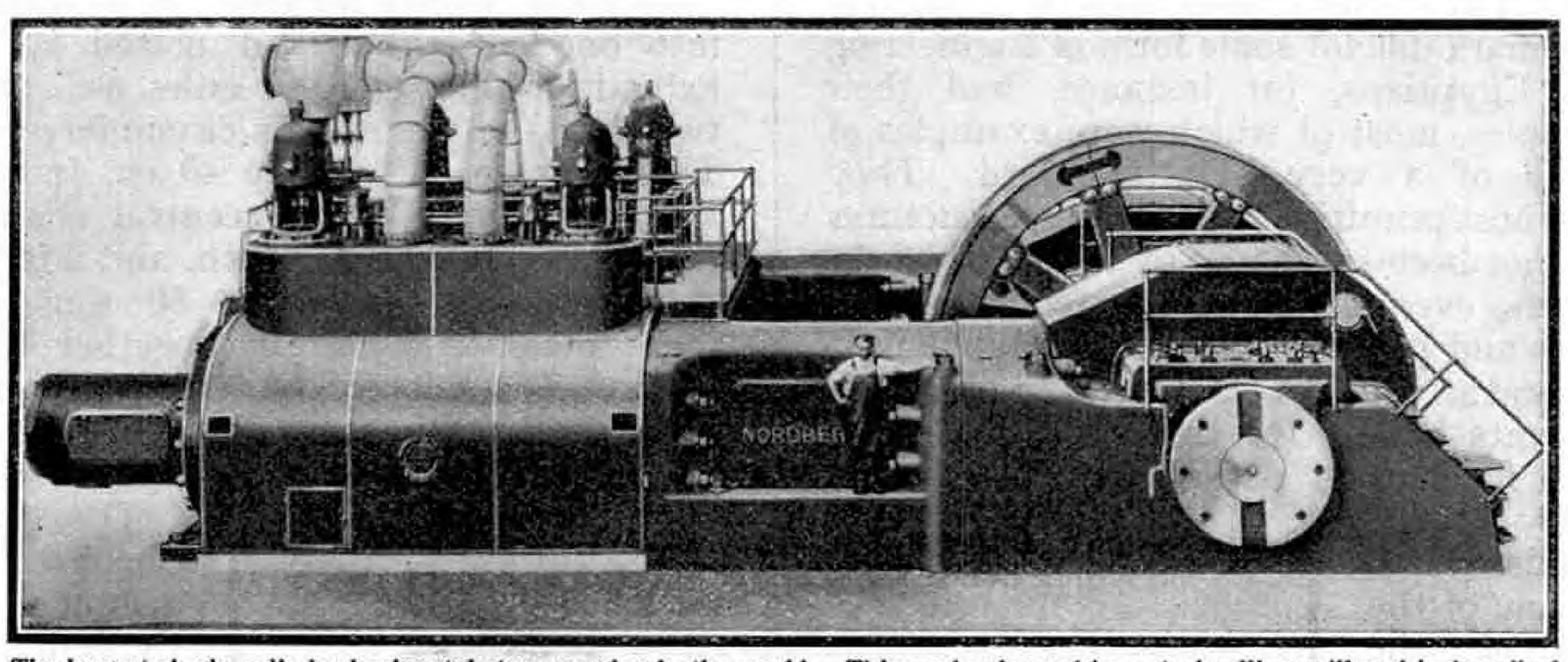
A dam that is being constructed across the Abitibi Canyon in Northern Ontario will control water for a hydro-electric power system developing 305,000 h.p. The dam will be 250 ft. in height and 100 ft. in length, and current from the adjacent power station will be distributed by means of a transmission line 260 miles in length. The line is designed to carry current at 132,000 volts and the whole of the work is expected to be completed by February of ne t year.

Roads with Iron Surfaces

Experimental roads recently laid down at London and Worcester are covered with iron blocks about 2 in. in depth. Their surfaces are marked with a special diamond pattern in relief, and it is almost impossible to make a car skid on roads built in this manner.

World's Largest Horizontal Steam Engine

The illustration on this page shows an engine that has the distinction of being the largest single-cylinder horizontal steam engine in existence. This giant develops a maximum of about 16,000 h.p.; its cylinder has a bore of 60 inches, a stroke of 66 inches and its normal speed is 90 r.p.m. It was built by the Nordberg Manufacturing Company, of Milwaukee, Wisconsin, for installation in a rolling mill at Youngstown, Ohio. The rolls of these mills require a slow but constant speed. This type of engine therefore is specially suitable, for it not only eliminates the unavoidable losses in power that occur when high speed engines or motors are used and geared down, but also shows extreme economy due to its low steam rate on the widely varying loads that are constantly being encountered in the rolling of steel.



The largest single-cylinder horizontal steam engine in the world. This engine is used in a steel rolling mill and is described on this page.

Giant American Steel Plate Mill

What is claimed to be the world's largest steel plate mill recently has been completed in Chicago, U.S.A. This is 2,120 ft. in length and is equipped with electric motors that develop 30,000 h.p.

The mill is capable of dealing with plates of all widths up to 7 ft. 8 in., and these may be rolled in lengths up to 140 ft. at speeds between 350 ft. per min. and 700 ft. per min. A gear drive included in the mill also is claimed as the largest yet attempted, for in it there are two gear wheels 21 ft. 8 in. in diameter that have faces 6 ft. in width.

Electric Light and Power from Peat

A Russian power station 75 miles from Moscow has been designed to operate on peat fuel. It is called the Shatura Station, and is situated near a large bog, from which the peat is washed into a large pit by means of powerful hydraulic jets. The wet sludge is pumped on to fields to dry, after which the peat is cut into sods of suitable size by a machine hauled by a caterpillar tractor.

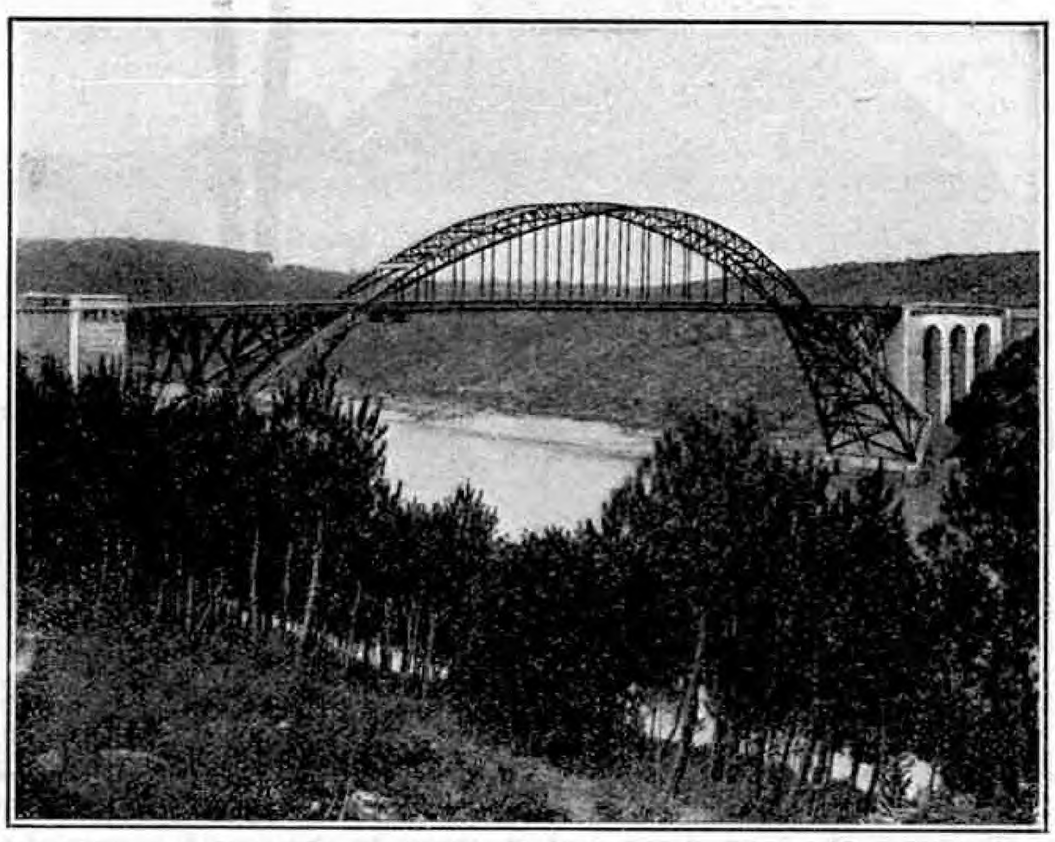
There are three large boiler houses in the station and the boilers are equipped with modern chain grate stokers that have been specially adapted for use with peat. The sods are placed on the grate and carried into the furnace, where peat dust is dropped on them as they burn.

A new boiler recently installed at the station makes use of peat dust only. It has no chain grate, but is provided with oil burners to raise the temperature before the dust is fed into it. The type of boiler that proves the less economic will eventually be scrapped.

Canadian Road 3,500 Miles in Length

Definite steps are now being taken in connection with the construction of a road across Canada that will be 3,500 miles in length, and thus will be one of the longest in the world. Work has already been commenced on certain sections of this great Dominion highway, and at least one section is expected to be completed before 1st July, 1932.

The road will connect Glace Bay, Nova Scotia, and Vancouver, British Columbia, and will pass through all the nine provinces of the Dominion with the exception of Prince Edward Island. It is to be constructed in sections by the various provincial authorities with Federal assistance, and the work will involve the improvement of existing roads as well as the construction of new ones. The greatest length to be constructed by a provincial government will be in Ontario, for the section crossing that province will be 1,200 miles in length. The highway will eventually be brought up to a standard to be prescribed by the Dominion Government.



The bridge of La Roche-Bernard in the Morbihan region of France. This interesting bridge, which is of the arch type and has long approach viaducts, was constructed in 1925.

New South American Bridge

A project for the construction of a new bridge over the River Riachuelo at Buenos Aires is now under consideration. The bridge will be nearly 600 ft. in length and about 75 ft. in width and will replace a structure that is unable to cope with the increased road traffic of the city.

Aqueduct 265 Miles in Length

An aqueduct 265 miles in length is now being constructed in California, U.S.A., in order to carry water from the Colorado River to Los Angeles and other towns in the south of the State. The flow of water in the river will eventually be regulated by means of the Hoover Dam, now under construction by the U.S. Government at a point above the intake of the aqueduct, and it is expected that at all seasons sufficient water will be obtained to supply the needs of the towns taking part in the scheme.

The aqueduct will be carried underground at many points in its course, and one of the tunnels to be constructed will be 13 miles in length. The giant tube will have a maximum diameter of 17 ft., and will allow the passage of nearly 1,000,000,000 gallons of water in 24 hours. Its cost is expected to be no less than £40,000,000.

New Bridge for New Zealand

Auckland Harbour is to be spanned by a bridge that will connect the city of Auckland with its suburbs. The work of construction is to start next year, and is expected to provide employment for more than 700 men for two and a half years. The contract for the work has been secured by Dorman Long & Co. Ltd., the well-known Middlesbrough firm of bridge-builders who are constructing the Sydney Harbour Bridge.

Diesel Engines for Road Vehicles

Diesel engines made by L. Gardner & Sons Ltd., Patricroft, Manchester, were among the earliest engines of this type to be employed in road vehicles and more than 200 of these engines are now used in this manner in various parts of the world, 150 of them in Great Britain. The firm has now produced a new series of Diesel engines. These are available in models having four, five and six cylinders, and rated at 29 h.p., 36.29 h.p. and 43.5 h.p. respectively. Under test on the bench, the six-cylinder engine has developed 102 h.p. at 1,700 r.p.m.

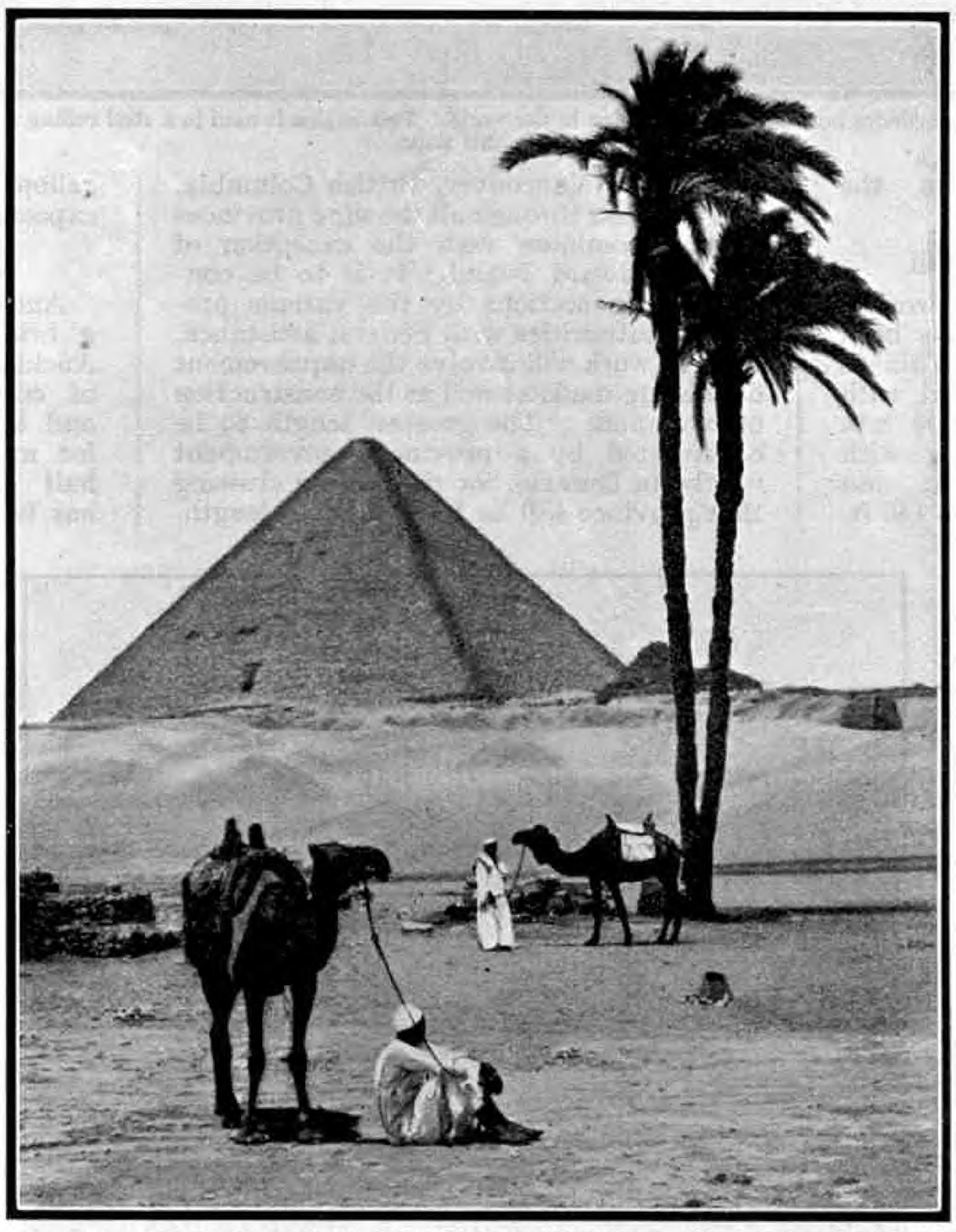
The new engines are of normal design but the governor and the starting arrangements are interesting features. The governor is of the centrifugal type and is totally enclosed. It is actuated by an accelerator and automatically varies the quantity of fuel passing into the cylinder as the load on the engine changes. No special heating devices are required to give easy starting from cold, the standard self-starter fitted being capable of doing its work without the aid of auxiliaries of this kind. A further advantage of the engine is that the sprayer valves require no adjustment by the user and are easily reassembled after dismantling.

Engineering in Ancient Egypt

Building the Great Pyramid

IN ancient times the nations that rose to greatness were always remarkable for some form of engineering ability. The Egyptians, for instance, had their pyramids and temples, most of which were examples of engineering ability of a very high standard. They possessed only the most primitive tools, but the structures they erected have not been surpassed by the great works of modern engineers, even though the latter have been aided by numerous and powerful mechanical appliances. The immense size and strength of the Egyptian pyramids and temples accounts largely for their long resistance to the destructive floods that periodically have swept through the valley of the Nile. The pyramids, which were regarded as one of the Seven Wonders of the Ancient World, number about 75, and are situated in groups over a wide area of the Eastern desert not far from Cairo.

The best known group of pyramids is that of three near Gizeh, which were built by the kings Cheops, Chephren and Mycerinus, of the fourth dynasty, about 3998 to 3721 B.C. The pyramid of Cheops is the greatest of the three, and has the distinction of being the largest mass of masonry ever erected. The polished granite and limestone slabs with which it was encased have been removed at some time, and as a result the structure is now some 30 ft. to 40 ft. lower than it was originally, and its base also is smaller. When the pyramid was built it measured 768 ft. square and was 482 ft. in height, that is 122 ft. higher than the Cross of St. Paul's Cathedral, and nearly 200 ft. higher than the Capitol at Washington. It is so huge that if it were hollowed out and the great church of St. Peter, Rome, were placed inside, nearly half of the ground space would still be vacant.



An engineering wonder of a vanished civilisation. The Great Pyramid of Cheops is the largest mass of masonry in the world, many of the blocks of which it is built weighing from 50 to 60 tons.

Wonderful exactitude is shown in the construction of the pyramid, the base of which forms practically a perfect square. The error in the length of the four sides averages only three-fifths of an inch, and the degree of inaccuracy in the angles is even less. The pyramid is estimated to contain the enormous number of 2,300,000 blocks of stone, or sufficient to build a wall completely round France. It is estimated that if cut into one-foot cubes and placed in line, they would extend for almost 17,000 miles, a distance equal to about two-thirds of the earth's circumference at the Equator. The stones each average 40 cu. ft. and those forming the arched roof of the central chamber are 19 ft. in length, nearly 4 ft. in depth, and 2 ft. in breadth, many of them weighing about 50 tons. So perfectly do these massive stones fit together that no additional support is necessary to withstand the pressure of the great weight of masonry above, showing that the Romans understood clearly the principle of the arch.

The pyramid built by Chephren stands a short distance from the Great Pyramid, and is slightly smaller. The third pyramid, which is almost in line with the other two, is only 203 ft. in height and 354 ft. 6 in. square at the base.

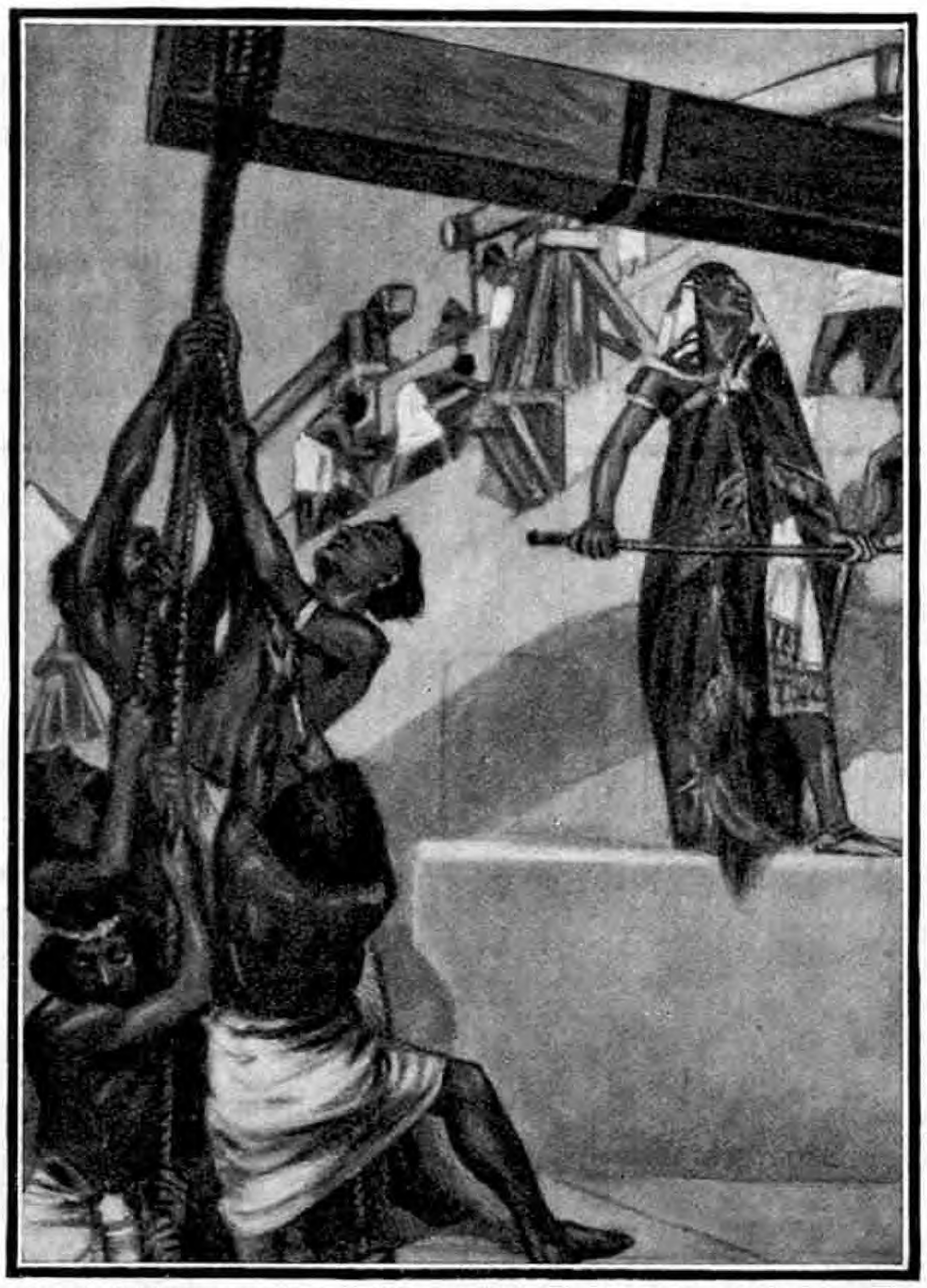
It is unfortunate that so little is known of the engineering methods of the ancient Egyptians, but from such evidence of their works as still exists, it is obvious that these methods must have been highly efficient. The pyramids and other large structures, built of materials quarried at places sometimes hundreds of miles distant, prove the Egyptians to have been expert in the hewing, transporting and handling of huge masses of stone.

The stone used in the building of the pyramids was quarried from the Mohatton Hills, some 30 miles away and on the opposite bank of the Nile. The polished granite with which the pyramids were cased was quarried at Syene, near Assuan, 500 miles up the river. The great blocks of stone were cut by driving in a number of wooden wedges along the line of cleavage. The wedges were then soaked with water, causing them to expand and sever the stones, which were next shaped and smoothed with marvellous skill and accuracy. The finished stones were afterward conveyed down the Nile on huge rafts. On completion of the journey down the river the stones were hauled overland on sleds by large gangs of slaves to the site of the pyramids, a distance of about three-quarters-of-a-mile, along an inclined road built of

polished stone. It is very probable that the smooth-surfaced roads were watered to further reduce friction.

According to the historian Herodotus, 100,000 workmen were employed for three months in each year in constructing this road, and the task, together with the excavation of the underground chambers of the pyramids, took 10 years to complete. The work on the building of the pyramids was similarly restricted to three months in the year. Probably this was the period when the annual overflow of the Nile made agricultural work impossible, and there would thus be an ample supply of native labour available for work on the pyramids. The remaining nine months of the year were not wasted, however, and a large number of workmen must have been engaged continuously in quarrying and preparing the stones for the builders.

We do not know exactly what means the Egyptians adopted in constructing the pyramids. In respect to the Great Pyramid Herodotus states that "it was first built in the form of a flight of steps. After the workmen had completed the pyramid in this form, they raised the other stones by means of machines, made of short beams, from the ground to the first tier of steps. After the stone was placed there it was raised to the second tier by another machine, for there were as many machines as there were tiers of steps. Perhaps the same machine, if it were easily moved, was raised from one tier to the other, as was required for lifting the stones. The highest part of the pyramid was thus finished first, and the parts adjoining it were taken next, and the lowest part, next to the earth, was completed last."



An artist's conception of the building of the Great Pyramid, showing men at work under the supervision of a taskmaster.

A different theory was put forward a few years ago by Dr. C. S. Fisher of the University of Pennsylvania, on his return from a six-years' visit to Egypt as head of archæological expeditions. According to Dr. Fisher the sleds used by the Egyptians for moving blocks of stone had a curved base so that they could be rocked to and fro. Wedges were driven under one end of a stone block that was to be transported, raising it sufficiently for one end of the sled to be pushed beneath it. The block was then dragged further on to the inclined sled until this resumed its normal position and the huge block was safely balanced on the centre. It was now ready for hauling to its destination.

The rockers or sleds are also believed to have been used to lift the blocks to any desired height. The manner in which this could be done was both simple and effective, all that was necessary being to weigh down one end of the sled and wedge securely the up-raised end. The block could then be hauled up the inclined sled until it overhung another stone on which it would be received by a second sled. By a succession of sleds, or by lifting up the first one to a position above the second, the stone could be raised to any height.

The Great Pyramid, like all the others, was the tomb of the royalty of ancient Egypt. When the royal chambers in the interior had received their dead, the pyramid was closed. The granite stones fitted together so perfectly that the entrance was effectively concealed, and the polished sides of the pyramid made it impossible for the structure to be scaled. The exterior of the pyramid has been removed, and the entrance is now revealed, while the rough-hewn blocks of the interior are exposed to view. The pyramid can now be ascended easily, and though the task is fatiguing the climber is amply rewarded by the view obtained from the platform at the summit.

The entrance to the Great Pyramid is near the middle of the northern face and about 50 ft. from the base. The passage is lined with fine limestone and slopes downward into the pyramid at an angle of about 26 degrees. Other passages lead off from it to various chambers. In common with the passages in other pyramids they were made only just large enough to admit the stone coffin or sarcophagus. Some of the chambers are very large. The King's chamber, for instance, is 34 ft. 3 in. in length, 17 ft. 1 in. in width and 19 ft. 1 in. in height, and above it are five smaller chambers evidently designed to lighten the pressure of the upper masonry. The Queen's chamber is a smaller compartment with a pointed roof.

For a long time it was believed that the pyramids of Egypt were merely tombs, but scientific investigation has shown that the Great Pyramid, at least, was intended also to hold the scientific secrets known to the ancient Egyptians. Experts who accompanied a French expedition to Egypt in the time of Napoleon made a careful survey of the Great Pyramid. They were astonished to find that its prolonged diagonals conform exactly to the Nile delta, and that the meridian passing through the apex of the pyramid divides the delta into two equal parts. The pyramid is so situated that its four sides are directed towards the cardinal points of the compass, and astronomers have found that the error in its position is less than five minutes.

The Egyptian pyramids were all built on the western side of the Nile, on the side of the setting sun, this situation being intended as a symbol of death; and each group of pyramids was made the centre of a cemetery. During the time of the pyramid-builders regal power in Egypt seems to have been very strong, for successive kings concerned themselves almost exclusively with the building of these huge monuments which were to be their own memorial. The work was given priority over the affairs of the nation, and enormous numbers of the people were employed on it. Later kings however took a greater interest in the welfare of the country, and the construction of the royal tomb ceased to be the chief work of a king's reign.

The Great Buffalo Rodeo

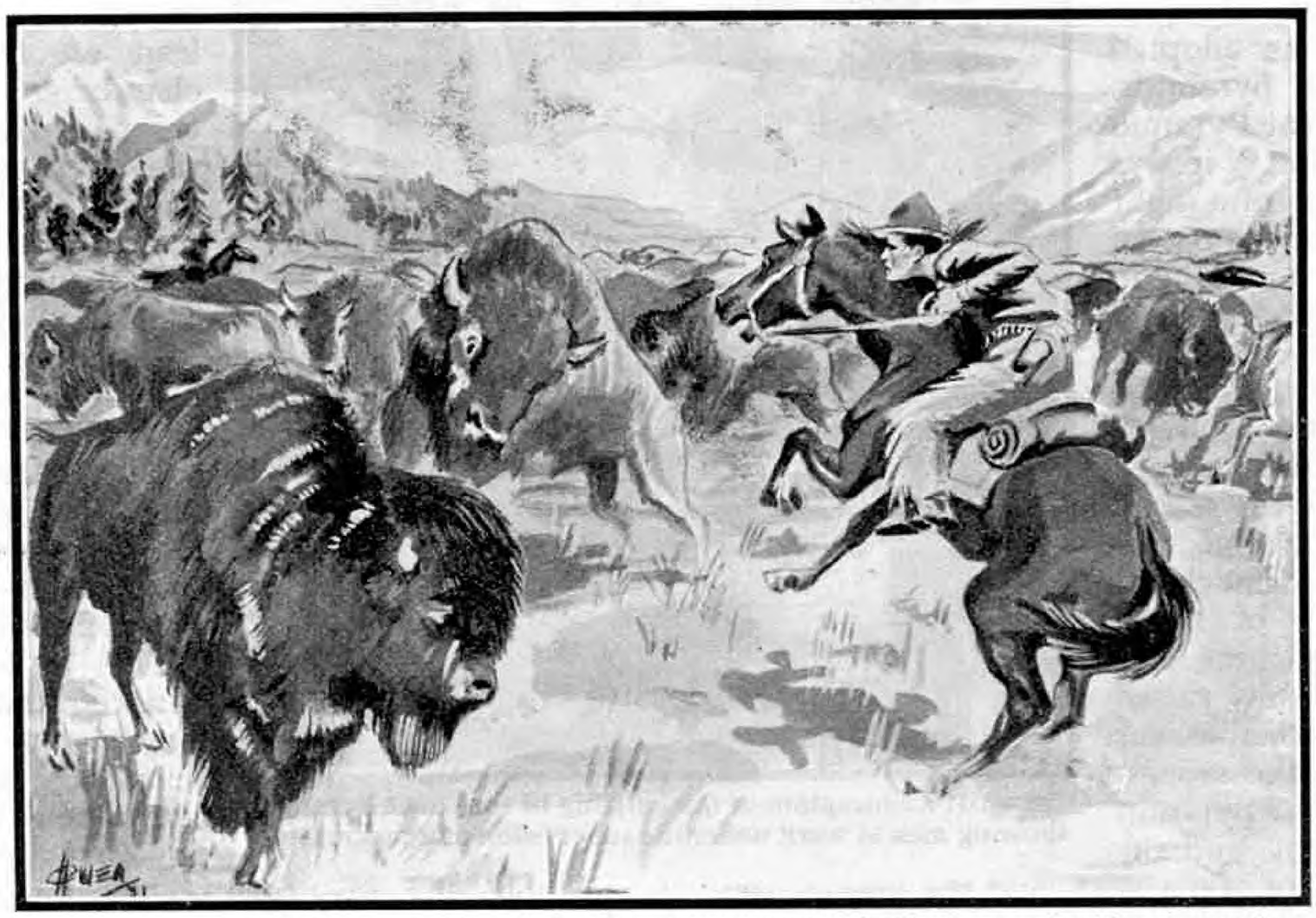
How the Herd Came to Edmonton, Alberta

By William D. Belbeck

WALKING COYOTE, an Indian of the Pond Oreille tribe, made only one mistake in his life, and in righting the wrong he had done he performed, all unknowingly, a great service to the North American continent—the preservation of the buffalo.

In the year 1873 Walking Coyote left his tribe and his wife, and married another squaw. His first wife heard about this, and naturally was angry. She informed her father, who promptly put on his war paint and took the trail after his erring son-in-law. News of his coming preceded his arrival, however, and Walking Coyote, considering discretion to be the better part of valour, galloped away into the east on a non-stop ride to Montana.

His new surroundings became tiresome after a while, and Walking Coyote found himself longing for his old home. He realised that something would have to be done to allay the ferocious feelings of his father-in-law before he could ever set foot on his old stamping grounds again. Something in the way of a gift might do the trick, but what gift could he secure that would act as a salve? Driven to desperation, he finally hit upon the very thing, he would take back to the old man some buffalo calves. These creatures were very scarce, and would be appreciated for that reason, together with the fact that his father-in-law was very poor. So when Walking Coyote reappeared in his native country four buffalo calves accompanied him. The old man accepted him with open arms, and regarded the calves as a gift from Manitou.



"Every now and then one of the ferocious old bulls would wheel round without warning, as he was being pressed by a horse and rider, and charge head-on into his tormentor."

The Fathers of St. Ignatius Mission had been working among the Pond Oreille Indians for some time, and finally they won Walking Coyote's father-in-law to the teachings of Christianity. The old man was so impressed with their kindness that he presented them with the four calves in token of his appreciation, and the Fathers took them to the Mission, where they were given good care. They grew to maturity and multiplied, and by 1880 the small herd had grown to 13.

In the meantime Walking Coyote had got the idea that within a few years the buffalo of the plains would reach extinction. He was shrewd enough to realise that when this occurred the herd of St. Ignatius Mission would be unique, and in consequence probably would be worth a great deal of money; so he immediately took steps to prove his part ownership of the animals. He went to the Fathers and told them his story. It was proved satisfactorily that at one time he had refused a cash offer from the factor of the Hudson Bay post, trading out of St. Ignatius, for his first four calves. The Fathers, who had no need or greed for money, and who had received the first four calves as a gift, immediately turned the 13 head over to Walking Coyote.

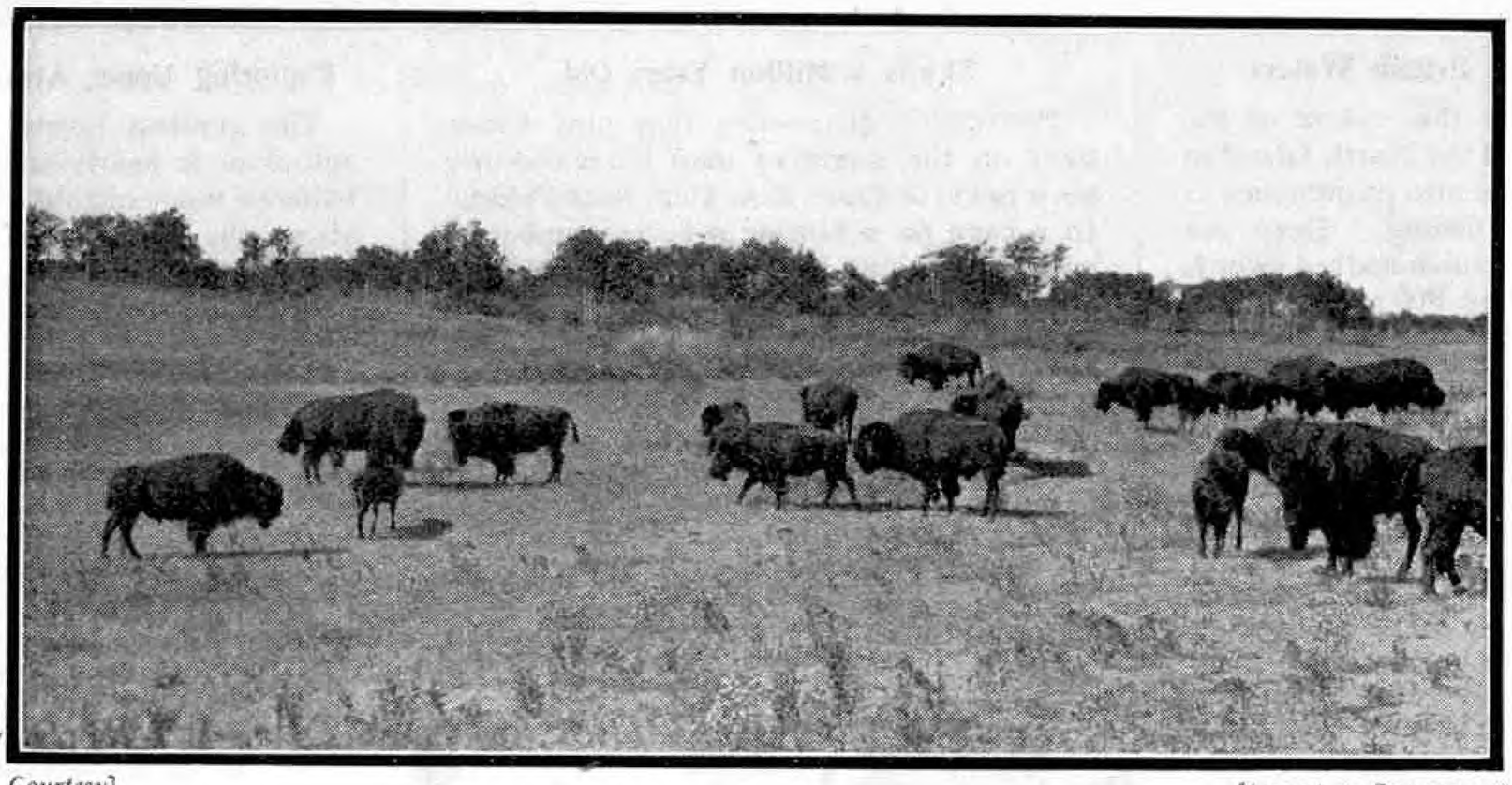
It is at this point that Mike Pablo, a Mexican half-breed, enters on the scene. He, too, foresaw the extinction of the buffalo, and realised that a man with a little wisdom would be able to make a fortune within a few years, provided he had a herd large enough to attract attention. He heard rumours that an Indian named Walking Coyote, of the Pond Oreille country, had a small herd that he was desirous of parting with in return for a few hundred dollars. Mike Pablo travelled up into the Pond Oreille country looking for him. He found him, and a bargain was struck to their mutual satisfaction. Walking Coyote was the richer by hundreds of good American coins, and Pablo had the nucleus foundation for his future wealth.

Pablo took his small herd back with him and ranged them on the Flathead Indian reserve land, which had not yet been thrown open for settlement; and while this herd was waxing fat and increasing in numbers, Pablo was scouring the north-west for additional animals.

About this time both the United States and the Canadian Governments had it brought to their attention that the buffalo was practically extinct. As is usual

in such cases where game is concerned, their attention was called to it when it was almost too late. The United States Government offered to purchase Pablo's herd. The offer was not anywhere near the figure that Pablo had set himself to accept, so he turned it down, none too politely. When the Flathead Indian reserve was thrown open for settlement, Pablo was served with notice by the United States Government to accept their previous offer of purchase, or to remove his herd from the Flathead land. Through his friendship with the Canadian immigration officer at Missoula, Montana, Pablo got into direct touch with the Canadian Minister of the Interior, and after a long correspondence the Canadian Government agreed to purchase his entire herd at 245 dollars per head, delivered at Edmonton, Alberta.

As soon as the conditions of sale had been completed, Pablo hired a group of range riders to round-up his herd. He had been dealing under the impression that he was the owner of about 200 head, but when the round-up was finished and the total count taken, he was surprised to find that his herd consisted of over 700 animals. As his contract merely stated that the Canadian Government was prepared to take his entire herd, the Government was obliged to pay Pablo a sum of more than 171,500 dollars, or about £34,300. Pablo's foresight was well rewarded; his dream of fortune became a reality.



Courtesy] *[Canadian Government*

Buffalo in Buffalo Park, Wainwright, Alberta

The round-up of Pablo's mighty buffalo herd was one of the most spectacular impromptu rodeos ever staged in the history of the West. Having lived their entire lives within the bounds of the Flathead reserves, and under the protection of the long arm of Uncle Sam, they had never been molested. As a result they were as wild as deer, and when Pablo turned his 40 range riders loose among them they plainly showed their resentment. Prior to commencing his round-up Pablo had constructed large, strong corrals, into which the animals were to be driven and kept ready for shipment northward. The cows and the calves were handled fairly easily, but the old bulls gave these riders the excitement of their lives. They soon found the rounding-up of wild range steers to be mere child's play in comparison. Every now and then one of the ferocious old bulls would wheel round without the slightest warning, as he was being pressed by a horse and rider, and charge head-on into his tormenter.

When the first consignment left Ravalli, Pablo breathed a great sigh of relief. It was not only the rounding-up of the buffalo that worried him, but in addition the people of the Flathead country had given him some anxious moments. When these settlers realised that the buffalo were going to Canada, they got their heads together and raised such a roar that the sound of it reached Washington, and even filtered into the President's sanctum. But Washington, which already had been in touch with Pablo and had its offer refused, had had enough of this buffalo business.

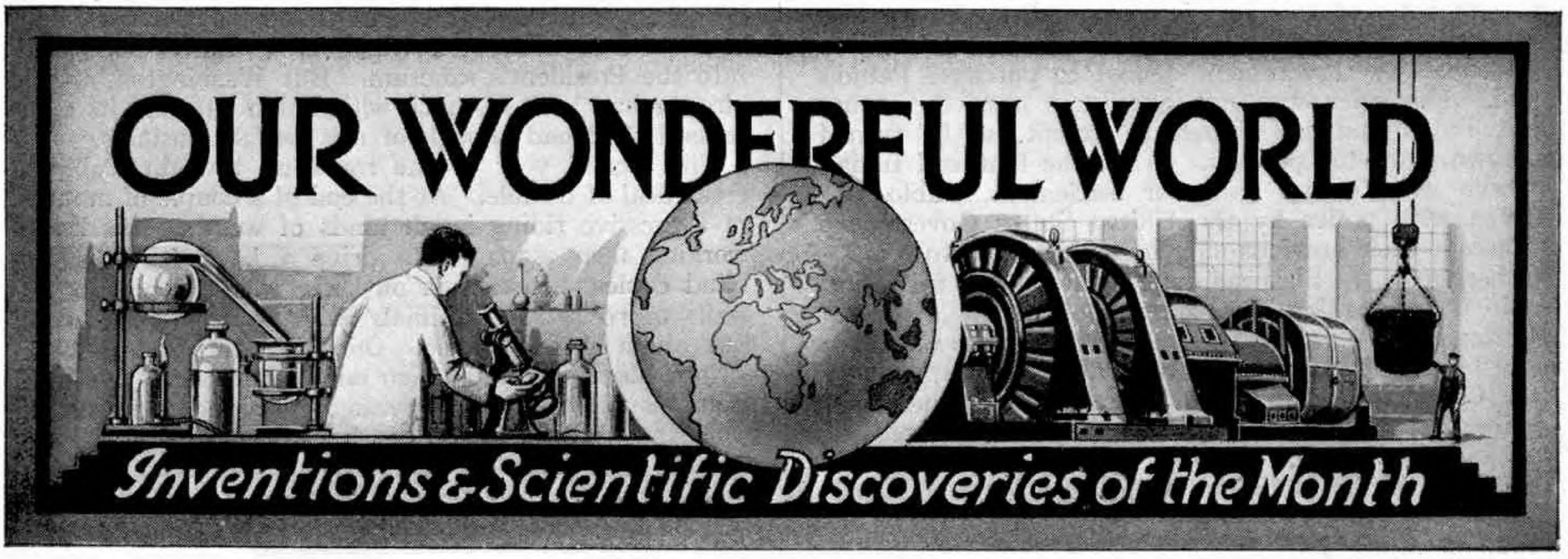
The second year of the round-up brought Pablo a great deal of trouble. At the end of a couple of months of aggressive riding in all kinds of weather, his hard-working men managed to drive a large herd into a blind coulee, hemmed in on three sides by precipitous walls of rock. The animals were kept in there until just about shipping time. One night an old bull took it into his thick head to go on the rampage. He rose from his bedding-ground with a rush and a roar and, with the entire herd at his heels, charged the coulee mouth. The riders were fortunate in escaping with their lives as they hurriedly cleared out to give the thundering herd passage room. Finally the rumble of their hoofs disappeared into the silence of the night.

Pablo was disheartened, and was ready to quit for that year, when there came to him a swaggering young cowboy with the boast that he could round up and make ready for shipment any buffalo that ever pawed dirt. Pablo accepted his proposition on the spot. He was to corral not less than 125 head before autumn, for which Pablo agreed to pay him 2,000 dollars. If he rounded up less than that number, he was to get exactly nothing. Accordingly he took charge of Pablo's riders and started off. Within a few weeks he had rounded-up more than 300 head, but of that number he herded only one-third into the corrals at Ravalli. Pablo schemed to round up the remainder of the herd.

Across a narrow neck of land formed by an elbow on the Pond Oreille River, Pablo stretched a strong wire fence, thus making a natural enclosure, for the steep banks of the river formed an inescapable barrier. On the outer side of the river Pablo stretched two additional fences, which ran out on an angle from the enclosure for three or four miles in each direction. These fences formed a triangle that converged towards the natural enclosure. They were completely shrouded in white cotton material to prevent the buffalo from going over or through them as they were driven towards the trap.

Here it was that the noble beasts of the western plains made their last stand for their primitive freedom. They succumbed to the superior forces of civilisation, but what a battle they fought! Seeming to realise that their last opportunity was facing them, the shaggy beasts demolished corrals, smashed box-cars, and played havoc with horses and riders.

At the end of a 52-hour journey the buffalo train reached Edmonton, where the animals were turned loose in Wainwright National Park.



Big Game Fish in British Waters

During recent years the waters of the Californian coast and of the North Island of New Zealand have come into prominence as centres of big game fishing. Deep sea anglers in New Zealand have hooked sword-fish weighing more than 900 lb. and have succeeded in landing these monsters after prolonged struggles. The fishing is done from motor launches, which are often dragged for considerable distances by the giant fish before these become exhausted and submit to capture.

Similar sport is obtainable in other parts of the world, and among the fish that are most eagerly pursued by anglers is the interesting tuna, or tunny as it is more often called. This appears to be one of the most erratic of all fish. Shoals are encountered for a period in certain places, and then they suddenly disappear, to be captured years later at places a considerable distance away. Huge tuna weighing as much as 300 lb. are now caught in the Gulf of Mexico, and even larger ones may be obtained on both the Pacific and the Atlantic shores of America. The largest specimen yet secured by rod and line weighed 680 lb. and was caught at Santa Catalina in California.

Additional interest has been given to deep sea angling by the discovery that the tuna is now present in British waters, specimens weighing 630 lb. and 560 lb. respectively having been caught off the Yorkshire coast. A still larger tuna was captured in 1912 in Poole harbour, where it had run aground on a mudbank. This monster was found to turn the scale at 728 lb.

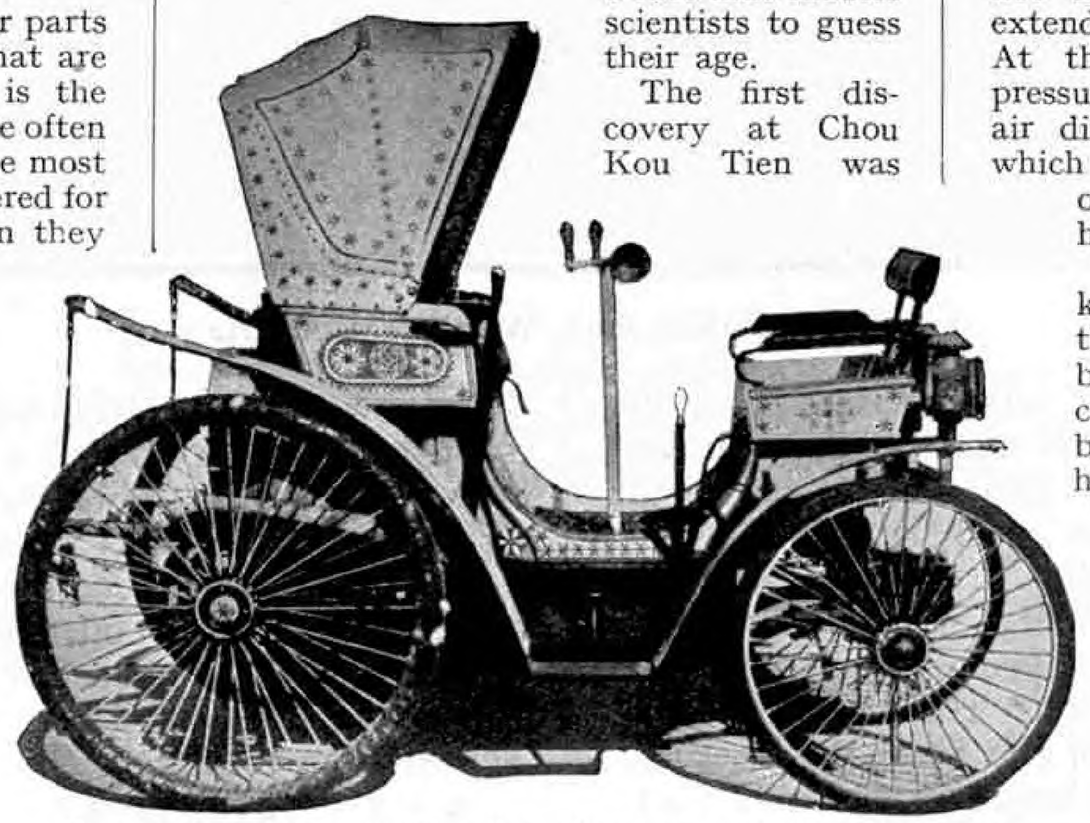
The tuna may be described as a giant mackerel, and indeed so closely does it resemble this fish in appearance that in New England it is known as the horse mackerel. It is capable of an enormous speed through the water, and its strength is prodigious. It lives chiefly on flying fish. These fish fly for short distances at a height of only a foot or two above the surface of the water. They are watched from below by the tuna, which immediately pounces on its victim when this is compelled, by the drying of its wings, to fall back upon the water. At times the tuna will even leap into the air in its hurry to secure its prey, and Californian anglers take advantage of this eagerness. They attach a kite to the bait, which then rises from the surface of the water and drops back again, in imitation of a flying fish.

Skulls a Million Years Old

Interesting discoveries that may throw light on the origin of man have recently been made at Chou Kou Tien, near Peking. In a cave on a hillside a large number of human teeth and fossilised skulls have been found, together with the bones of certain animals. The earliest remains of prehistoric mankind known before this discovery were found in gravels and must have been carried there by water, but the Peking skulls were associated with certain rocks, a fact that enables scientists to guess their age.

The first discovery at Chou Kou Tien was made in 1927 and consisted of a single tooth. Two years later further excavations revealed five more teeth and the greater part of a fossilised human skull. In addition, many petrified pieces of bone were found and these could be fitted together to form almost a complete skull that was different in shape from those discovered in Java and at Piltdown, Sussex, the oldest relics of early man previously known.

It is believed that the bones found at Chou Kou Tien are those of primitive human beings of about 1,000,000 years ago, and their discovery takes us nearer to the beginning of human life on earth, the date of which is thought to be 5,000,000 years earlier. As yet nothing resembling a tool or an implement has been discovered in association with the bones, but further investigations are now being made, and these may yet reveal interesting details of the manner in which these primitive beings lived.



Peugeot Car of 1895, an interesting relic of the early days of motoring.

Exploring Upper Atmosphere by Rocket

The greatest height yet reached in an aeroplane is nearly eight miles. Sounding balloons made of rubber have risen 20 miles above the earth's surface, and the shells from "*Big Bertha*," the giant German gun used for bombarding Paris during the Great War, rose about four miles higher during their flight through the air. Although at a height of 20 miles the barometric pressure is only about one-fiftieth of that at sea level, this distance is not the limit of the atmosphere, which extends to a height of about 250 miles. At that distance from the earth the pressure is very small, of course, and the air differs in composition from that to which we are accustomed, the proportion of oxygen being much less. Traces of hydrogen and helium also are present.

It is important that we should know more of the upper atmosphere than at present, for there is reason to believe that much of our weather is caused by changes in it. It has also been suggested that flying at great heights would be ideal, particularly when long trips are to be made. Sixty miles above the earth there are no clouds to hide the sun or stars; danger from lightning is absent; freezing troubles cannot arise, and disturbances and variations of pressure due to air movements are completely absent. Specially designed aeroplanes will be necessary, of course, and suggestions of the type of machine that could be employed have already been made.

The first step toward making use of the upper atmosphere would be to learn more of its composition. It will be necessary to obtain samples, and it has been suggested that rockets would prove useful for this purpose. These may be driven to a height of at least 25 miles, and specially designed projectiles may even reach a height of 100 miles. It would be simple to arrange that samples of air could be automatically sealed up in small tubes as the last portion of the propelling charge leaves the rocket, this being the moment when the projectile reaches its greatest height and is travelling slowly. A parachute attached to the vessel containing the sample would prevent damage on reaching the earth. Analysis of the air thus shot down, as it were, together with a measurement of the height from which it has been brought should give interesting information.

Destroying an Australian Plant Pest

In certain districts in Australia the prickly pear has for years been a terrible pest. The plant is a member of the cactus family and was apparently introduced into Australia many years ago in an attempt to develop the cochineal industry, this colouring matter being derived from an insect that thrives on it. Unfortunately it became so much at home in Queensland and in the northern portion of New South Wales, where the average temperature is high and the rainfall is limited, that it spread very rapidly. The large pads resembling leaves were carried long distances by water or animals, and readily developed roots whenever a favourable opportunity occurred. The seeds also were spread by various agents and these readily germinated. The result was that by 1927 an area of more than 60,000,000 acres were covered by the plant and 1,000,000 acres were being added to this total every year.

Strenuous efforts to stamp out the pest were made, but uprooting and destroying the plant proved futile. Finally it began to give way before the attack of tiny insects and to-day the area covered by the prickly pear is decreasing as quickly as it grew a few years ago.

The insects responsible for the destruction of the prickly pear were deliberately introduced from America. Before the great attack could be made, a long search for insect enemies of the cactus family was necessary, Mexico and the sandy deserts in the south of the U.S.A. being the chief hunting grounds. It was necessary also to establish stations where the appetites of these could be thoroughly tested. There was little difficulty in finding insects that would devour the prickly pear, but comparatively few of these could be trusted to do no harm to valuable cultivated plants. Each species was therefore tempted by various foods, and any that were not prepared to starve to death rather than eat useful plants were rejected.

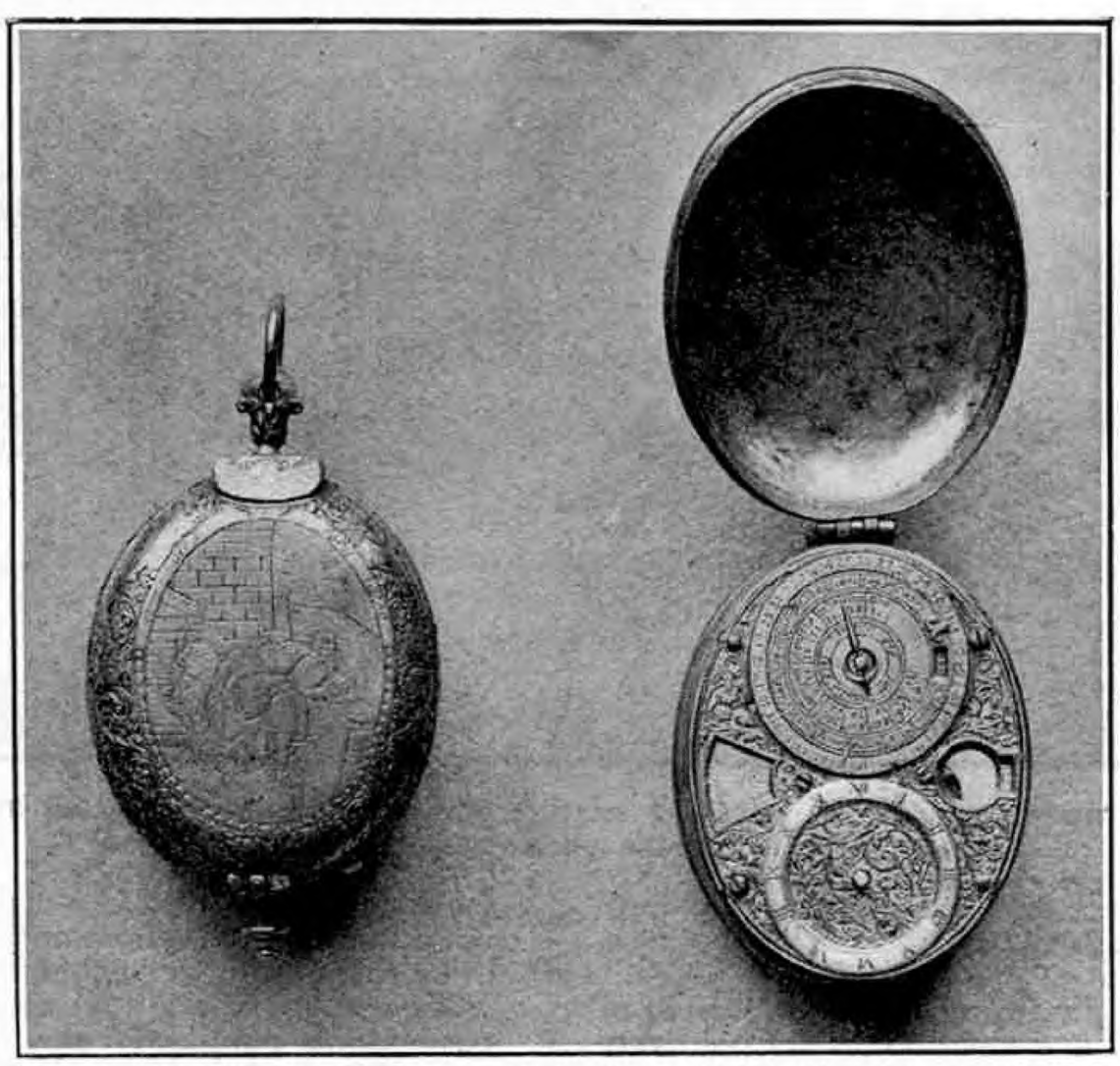
When the right kinds of insect had been discovered the next step was to transport them to the scene of action. This proved unexpectedly difficult, and it was necessary to make several shipments before thoroughly acclimatised insects could be reared in Australia. Even then the foes of the cactus were not allowed to commence their work until they had passed further tests of their appetite for the prickly pear and their dislike to useful plants. The selection thus involved much patient work, but the reward has been worth the time and money spent.

Several insects are now taking part in the war against the prickly pear. The most successful of these is a moth called *Cactoblastis cactorum*, a name that is ominous for the prickly pear. The caterpillar of this moth is 2 in. in length and is of a bright red colour with black spots. It lives inside the pads of the pear, where it is safe from birds and other enemies, and causes the plant to collapse by eating out the material inside these. *Cactoblastis cactorum* has found allies in various kinds of scale insects, spiders and bugs, but is now reported to be itself in danger of destruction by the attack of a tiny parasite.

The World's Greatest Tree

The oldest living thing in the world is believed to be a gigantic tree in the Sequoia National Park, California. The name of the park is derived from that of the giant trees, the largest in the world, that grow in it. Sequoias, as they are called, are found only in California, where two species are known. These are the giants of the Sequoia National Park, and a race of smaller trees that grow in the forests of the coast range of the State.

Many of the trees in the Sequoia National Park are considerably more than 200 ft. in height, and they are broad in proportion. The tallest of them—the tree that is regarded as the oldest living thing on earth—was discovered in 1879 and named after General Sherman. It towers to a height of no less than 280 ft. and is 36.9 ft. in diameter. Its age cannot be determined exactly without cutting it down. It must be more than 2,000 years old, however, for examination of the rings of a sequoia, only 21 ft. in diameter, that was blown down during a snowstorm in 1917 showed that the age of the smaller tree was 1,932 years.



Two interesting old watches. Left, a 17th century copper watch, filigreed and gilded. Right, another watch of the same period, showing the risings and settings of the Sun.

River that Flows in Two Directions

In Alberta, Canada, there is a river that at certain seasons of the year reverses its course. It is called the Rocher, and is a short stretch of water that connects Lake Athabasca with the Peace River, the two uniting to form the Slave River, which flows northward to the Great Slave Lake.

During the dry season Lake Athabasca has no outlet, and it is then fed by the water of the Rocher as well as by other streams in its basin. At these times the water of the Rocher comes from the Peace River, which apparently divides when it reaches the Slave River, part of it continuing northward, and part of it flowing south to Lake Athabasca. When the level of the water in the Lake reaches a certain height, however, the flow of the Rocher is reversed, and the river resumes its northward course. So far as is known, the Rocher is the only river in the world that changes its direction in this manner.

Copper in Arctic Canada

Stories of fabulously rich copper deposits on the Arctic coasts of Canada have been persistently circulated for many years. The region in which the metal was supposed to exist in enormous quantities is in the vicinity of Coronation Gulf and near the mouth of the appropriately named Coppermine River. It is only within recent years that the apparently inhospitable and very sparsely inhabited country has been thoroughly explored. The result has been partial confirmation of the legends, for it is now reported that extensive deposits of the metal have been discovered in it. The ore is extremely rich and present indications are that further discoveries will make the region one of great importance.

It is interesting to note that the country in which the deposits have been discovered has been prospected by means of aeroplanes, and without this form of travel it is probable that the ore would have escaped discovery for many years. The transport of the ore will offer difficulties, but if prospects warrant their construction, railways no doubt will be constructed. Alternatively water transport may be arranged, for ocean-going vessels already approach within 50 miles of the district. Large river steamers also ply on the Mackenzie River and possibly this service may be extended by way of the Great Bear Lake and other waterways in order to enable the ore to be shipped southward to Alberta, where it could be transported by rail to the smelting works.

Deceiving the Ant

In Uganda and other countries round Lake Victoria Nyanza ants are regarded as a great food delicacy and are eagerly sought for by the natives. At certain seasons of the year the ants emerge from their red earthen heaps, and then a scene of great excitement follows, natives of all ages rushing to catch the insects, which are either eaten raw or beaten into a pulp and fried.

If left to themselves the insects would normally emerge from the interiors of their heaps at the beginning of the rainy season; but in some districts the natives make them come out at other periods by deluding them into the belief that it is time to swarm. They do this by producing an imitation rainstorm. The first step is to cover each opening in the heap with a large leaf, and then to erect over it a structure of brushwood. Every crevice is filled in with twigs or leaves in order to make the interior as dark as if the sky were overcast, and only a small aperture is left. When the natives have completed these preparations to their satisfaction, they commence to make a deep drumming sound by beating two sticks upon a third stick laid on the ground near the doorway, and splash water on the ant-heap at intervals.

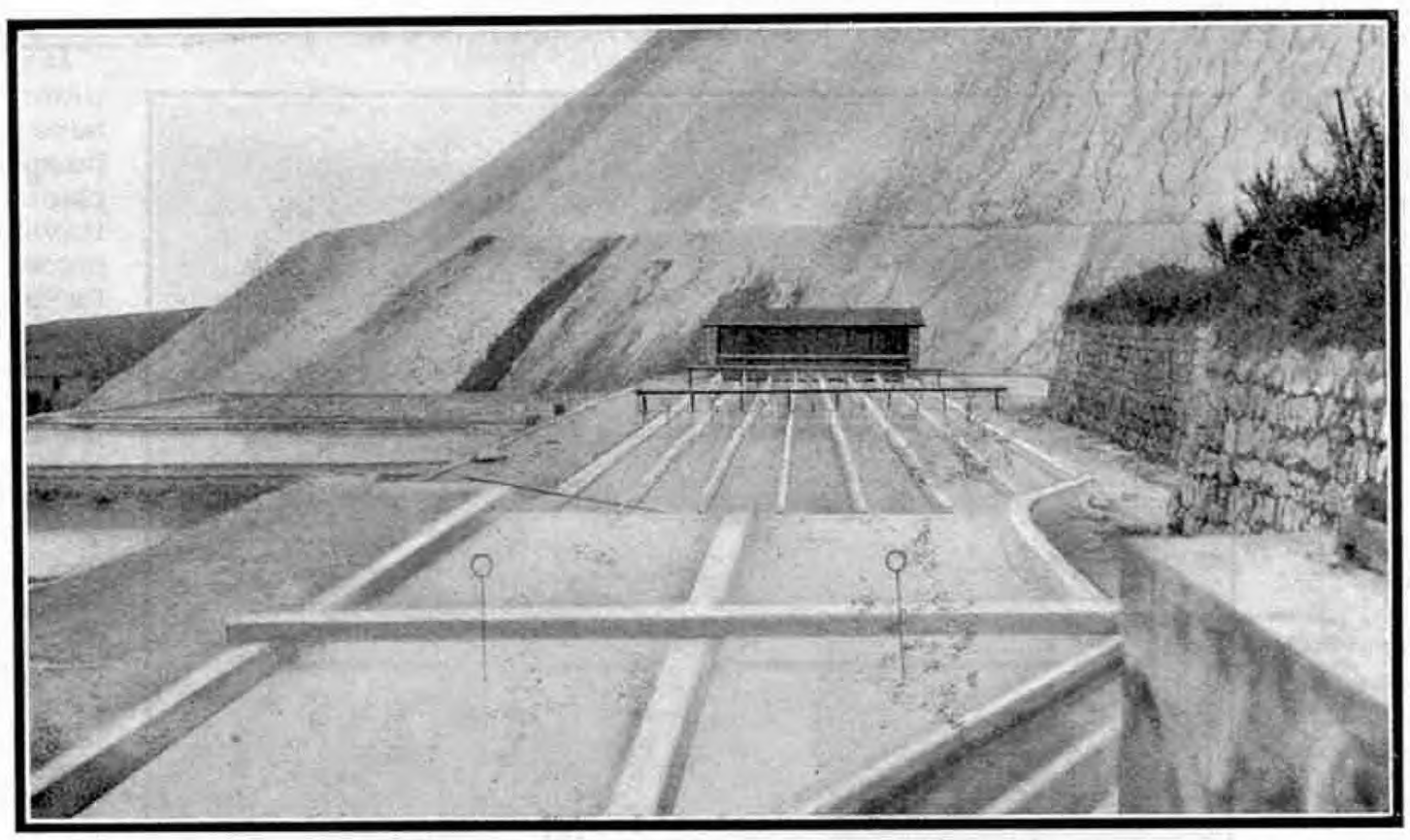
After about two hours of this performance the ants begin to show themselves, creeping out from the heap and making for the open. They find their way into a trench dug near the doorway, and this doorway is then covered with large leaves in order to prevent their escape. The conclusion of the whole operation is a feast for those who have taken part in it.

The Cornish China Clay Industry

By H. J. Shepstone, F.R.G.S.

A STRIKING feature of the landscape in certain parts of Cornwall, particularly around St. Austell and Bugle, is the great towering pyramid-shaped white mounds reaching to a height of 200 ft. to 300 ft. or more. In these districts another remarkable sight is that of little rushing streams the waters of which are as white as milk! The mounds are the overburdens or refuse heaps of the china clay mines, and it is this white clay that gives the milk-like appearance to the streams. The whiteness is everywhere. One comes across long partially-open sheds stacked with white blocks, and the very roads, buildings and everything else are covered with white dust.

The cause of all this whiteness, china clay, or to give it its correct name, "kaolin," is a valuable commodity that plays an important part in an astonishing variety of industries. From this material is made porcelain, the tiles that adorn our bathrooms and sculleries, and many of our common kitchen utensils. It is used in the manufacture of paper, calico and linoleum and, surprisingly enough, after undergoing certain processes it becomes a much sought after face powder.



Trough through which the milk-like mixture of clay and water is passed in order to separate out the mica and any fine sand.

China clay is just decomposed granite rotted by the action of water; but the exact cause of this decomposition is not positively known, and geologists differ in their views on the matter. Granite is an igneous rock that has been formed by the slow cooling of a molten mass at a considerable depth below the surface of the earth. Felspar, quartz, and mica are the principal minerals of which the Cornish granite consists, and the decomposition of the felspar gives us china clay.

The name kaolin comes from the Chinese word "kaoling," meaning "lofty hill," because it was first used from a mountain in China that bore this name. The clay from this district was sent to Europe by a Jesuit missionary, and for a time China was the only source of the substance. Not long afterwards a white clay of a similar nature was found in Saxony, and its discovery led to the establishment of the porcelain industry that produces the famous and beautiful Dresden china.



The settling ponds where, by evaporation, the clay is separated from the water, which finally runs out quite clear.

About the year 1755 this clay was found in Cornwall by William Cookworthy. Cookworthy was a Quaker and was born at Kingsbridge, not far from Plymouth, in 1705. His father, a weaver, died in 1718 when the boy was 13 years of age, leaving little or no provision for his family. The mother was faced with the serious problem of providing for a family of seven, which she succeeded in doing by dress-making. Young Cookworthy was apprenticed at the age of 14 to a chemist in London, and ultimately he commenced business as a chemist in Plymouth. His business prospered and he was able to spend a good deal of his time in travelling about Cornwall, his particular object being to find suitable material for the manufacture of porcelain, which he believed to exist.

It is interesting to note that Cookworthy was a firm believer in the supposed power of the "divining rod," or "dowsing rod" as it was called by the Cornish miners, to indicate the existence of metallic ores. He even went so far as to write and publish an elaborate description of the use of this rod.

It appears to be very doubtful whether Cookworthy ever found any mineral treasures by means of his "dowsing rod," but he certainly discovered the white clay of which he was in search, and he promptly proceeded to utilise the "caulin," as he called it, in the manufacture of porcelain. He established a factory at Plymouth, and before long was able to produce hard-paste china composed entirely of English materials.

In 1768 Cookworthy took out a patent for the manufacture of a "kind of porcelain newly invented by me composed of moor-stone or growan and growan clay." He laboured hard to produce porcelain equal to that of Sevres and Dresden, both in body and in ornamentation, and in this he succeeded to a considerable extent. He applied his chemical knowledge and experience to the work, and in particular he paid a great deal of attention to the production of a good blue. He was the first in this country to succeed in manufacturing cobalt blue direct from the ore, and the colour he obtained was of excellent quality. Although he was at that time in his 70th year it is said that he himself painted some of the earlier blue and white china produced in the factory that he had founded.

Although the productions of Cookworthy's Plymouth works were very beautiful and quite satisfactory regarded as china, they were unfortunately not successful from a commercial point of view. On account of various difficulties, prominent among which was the

entire absence of coal in the Plymouth district, he was unable to compete with the Staffordshire factories, and in 1774 he sold his business and his patent rights to Richard Champion, a merchant of Bristol, who transferred the works to that city.

By this time the importance of Cookworthy's discovery was becoming generally recognised, and several efforts were made by various people to monopolise the products of the Cornish clay mines. A keen struggle followed, in which the famous potter, Josiah Wedgwood, took a prominent part, and special Acts of Parliament had to be passed in order to secure the open use of the much-desired material.

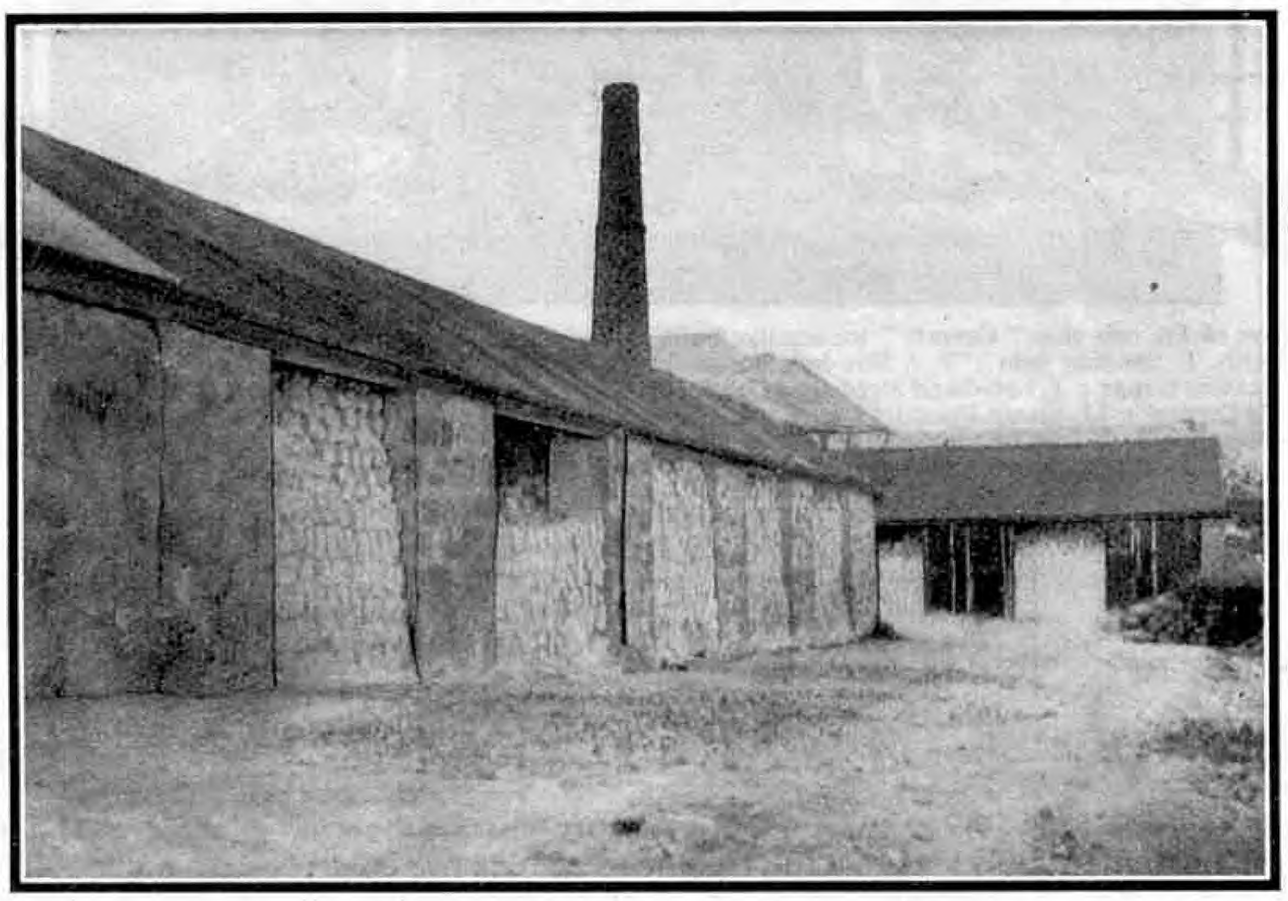
In the early days of the Cornish china clay industry the methods resorted to in securing the product were very primitive. The drying of the clay, for instance, was accomplished by evaporation in the sun, which meant that the extent of the supply was very much a question of "weather permitting." To-day the very latest scientific methods are employed, and a visit to a china clay mine is an interesting experience. The writer had the good fortune to be taken over the South-caudledowns mine recently by Captain Tabb, who kindly explained in detail its manifold operation. This mine is over one hundred years old and is famed for the high grade of clay produced, the output of which is over 5,000 tons per year. It should be stated that there are other mines with a much bigger output than this, some of them producing regularly as much as 30,000 to 40,000 tons of clay every year.



A typical 200-ft. mound of "overburden" or refuse from a china clay mine. At the summit may be seen the projecting terminus of the inclined railway up which the refuse is carried.

The mines are really vast open pits, and the one of South-caudledowns is over 300 ft. in depth. From its rim the toilers below appear no larger than ants. Its precipitous sides are cut into channels or streaks, and there workmen, locally known as "dubbers," are employed to break up the mass. This is dangerous work and the men are roped, for a single slip might mean death. In spite of all precautions fatal accidents do occur at times, but these are most often due to neglect or carelessness on the part of the men concerned. The dubbers are assisted in their task by a stream of water from open conduits called "launders." As the mass is loosened by pick and water it gravitates to the bottom, where it is caught in a large timber-built receptacle known as a "sand drag." Here the heavier parts of the material, stone, quartz and sand, sink to the bottom and are trapped. This waste matter is then shovelled into trucks, carried up an incline railway and shot out on the top of an ever-growing mound.

The lighter parts of the material, that is the clay and the mica, are carried in suspension to the bottom of the shaft. Here the liquid is raised by powerful pumps to the surface, at which stage it has the appearance of milk. The object now is to separate the mica from the clay, which is done by a process of sedimentation in a special trough. This receptacle measures some 300 ft. in length by about 20 ft. in width, and it is divided longitudinally into sections by boards placed about 2 ft. apart. The object of these boards is to catch or trap the mica and any fine sand that may have remained from the first washing in the mine. By the time the stream reaches the end of this trough only the purified clay remains at the bottom. It now has the appearance of thick cream and it passes through underground pipes to the settling pits. Here evaporation takes place and the clay is gradually separated from the water. This water is the same colour as the clay on entering the pit, but when finally it runs out as it reaches the top of the pit it is quite clear. It then flows into a special reservoir ready to be pumped back to the mine and used over again.

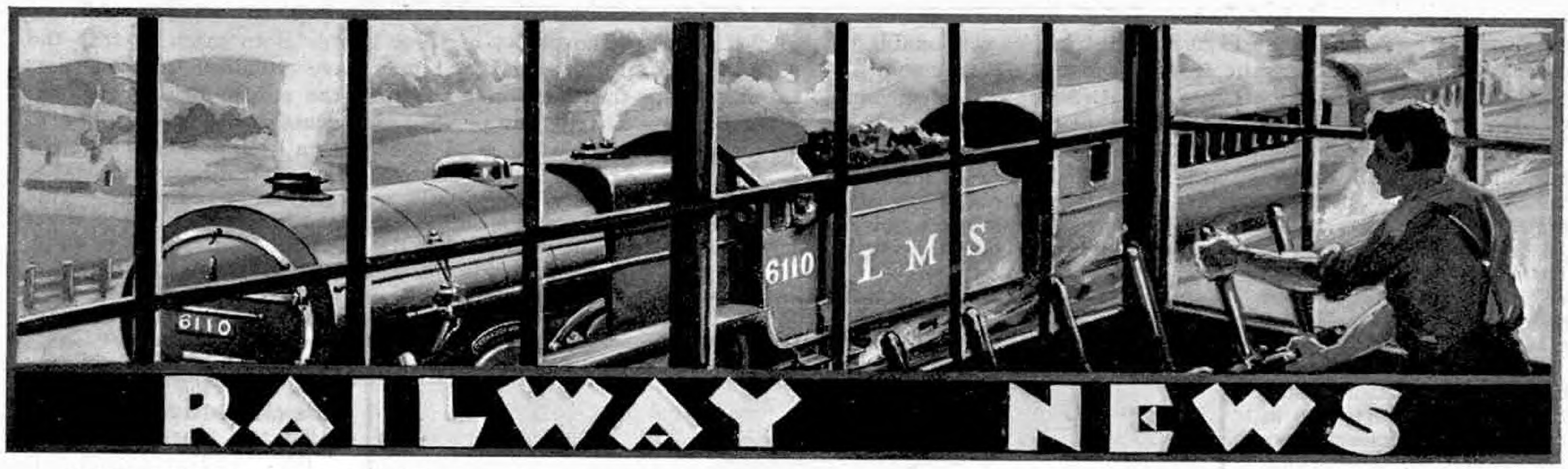


The "dry," or covered kiln, where the final separation of the clay takes place. At the openings of the shed may be seen blocks of prepared clay stacked up in readiness for despatch by rail.

When the open air process of drying is completed the clay is dug out of the pits and carried to the "dry," as the covered kiln that completes the separation, is called. Here the wet clay is spread over the floor to a depth of about eight inches. A furnace at one end provides heat that passes in flues underneath the floor through the whole length of the building. At a certain stage in this forced drying the clay is run through with a "cutter," which is dragged through the soft mass first lengthwise and then across, thus forming the clay into cubical blocks. This assists the drying by enlarging the exposed evaporation surface, and at the same time it divides the clay into lumps of a convenient size for handling. The forced drying takes from 12 to 96 hours, and experiments have shown that when the clay has been dried in this manner it still contains about 10 per cent. of constitutional water; that is, water that is chemically combined with the clay, and to the possession of which it owes its plastic qualities.

There are many varieties of china clay, and one of the problems facing the industry to-day is to dispose of the finer qualities. It fetches about £3/10/– a ton, and goes all over the world. Some idea of the extent of the industry may be obtained from the fact that the output of the Cornish mines to-day is well over a million tons a year—a great change from the early days of the industry when it is recorded that "one year's output of 100 tons created a glut in the clay market." Since then, of course, the clay has been applied to a variety of purposes in addition to the making of porcelain. We have already referred to its conversion into face powder, in which condition it is valued, not at £3/10/– a ton, but at well over £3,000 a ton!

It is interesting to learn that for thousands of years the kaolin of St. Austell prevented access to valuable lodes of tin that lay hidden beneath deposits of the clay that in some places are 30 ft. in thickness. The Cornish tin mining industry is very ancient and in prehistoric times was carried on in the Land's End region and on Dartmoor, Bodmin Moor and Camborne Moor. Remains of the stone buildings then erected may still be found in any of these places. No such ruins are found at St. Austell in spite of the presence of tin. The kaolin had masked the ore, and itself was regarded as useless until Cookworthy's discovery in 1755.



RAILWAY NEWS

Building Programme of L.M.S.R.

New passenger engines of the 4–4–0 "Class 2" type are being turned out steadily from the works at Crewe. Nos. 642 to 651 are the latest that have been put into service. When the present order for 25 engines of this class has been completed, some further 0–8–0 standard freight locomotives will be built.

Additional 2–6–2 passenger tank engines have been finished at Derby and are numbered 15545–52. Some of the standard 2–6–0 "Mogul" tender engines are in regular work on the Highland line, for which they have shown themselves well suited.

In the *"M.M."* for April last, a description was given of the new patent self-trimming coal-bunker that had been fitted experimentally to the "Beyer-Garratt" locomotive No. 4986. This has proved so successful in service that the other engines of this type at work on the L.M.S.R. are to be similarly equipped.

The reconstructed "Claughton" No. 5902, *"Sir Frank Ree,"* has been transferred to Manchester (Longsight shed) and is working on the expresses between Manchester and Euston.

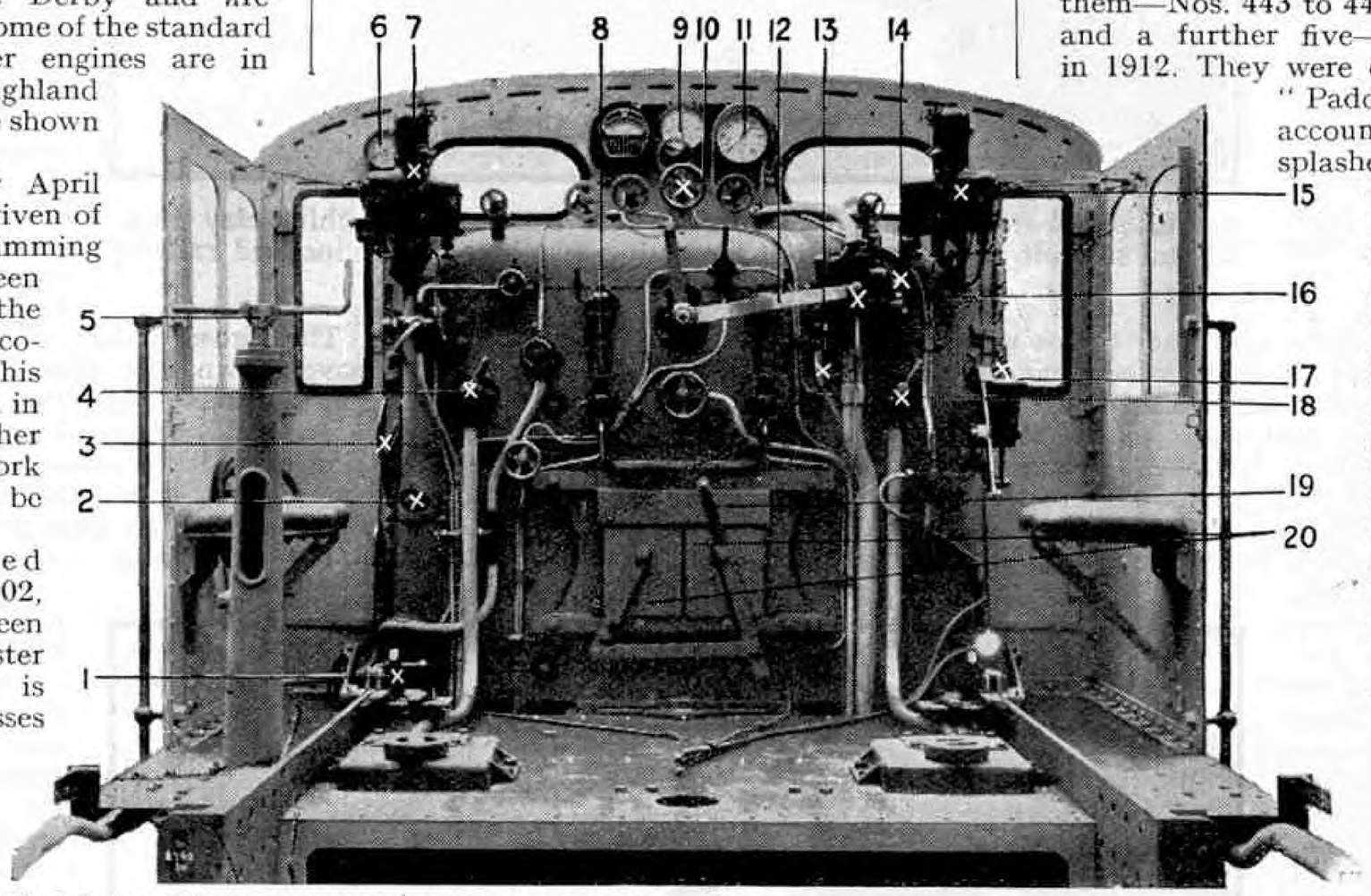
Engine No. 5450, *"Experiment,"* has been withdrawn for scrapping. This was the first 4–6–0 express locomotive built by Mr. G. Whale for the L.N.W.R. and gave its name to the noted "Experiment" class. It was built at Crewe in 1905 and then bore the number 66.

Automatic Train Control on G.W.R.

Early in September, when the last ramps were fitted on the Weston-super-Mare loop lines, the whole of the G.W.R. main lines between Paddington, Wolverhampton, Swansea and Plymouth were brought under that company's system of automatic train control. In all, 2,130 miles of track and 2,500 engines have been equipped at a total cost of £250,000. This system, which was described in the March *"M.M."*, greatly increases the safety of operations, and is of particular value during foggy weather. Audible warning of the state of the signal is given to the driver, and the train is automatically brought to a standstill if a danger signal is passed.

A Mammoth Tender

The Pennsylvania Railroad in the United States of America has recently built a tender of exceptionally large dimensions for experimental use with one of its "Pacific" express passenger locomotives. The tender carries 20,340 gallons (British) of water and 22 tons of coal. This large capacity enables the locomotive to make long runs and eliminates delays due to stops for coal and water. The tender runs on two six-wheeled bogies and when loaded weighs 176 tons.



The interior of the cab of a "Garratt" locomotive built by Beyer, Peacock & Co. Ltd. The fittings are numbered as follows :—No. 1, Sanding gear ; 2, A Fire-box Stay-end ; 3, Damper ; 4, Left-hand Injector cock ; 5, Handbrake ; 6, Train Heating Gauge ; 7, Left-hand Sight-feed Lubricator ; 8, Left-hand Water-gauge ; 9, Air-brake Gauge (Vacuum); 10, Whistle Control ; 11, Steam Pressure Gauge ; 12, Regulator Handle ; 13, Ejector Steam Valve Handle ; 14, Ejector Air Valve Handle ; 15, Right-hand Sight-feed Lubricator ; 16, Ejector ; 17, Reversing Gear Control ; 18, Right-hand Injector Cock ; 19, Firehole Door Lever ; 20, Firehole Doors.

Progress of S.R. Electrification Scheme

Electric cables have been laid through Merstham Quarry Tunnel in connection with the extension of the Southern Railway electrification scheme to Brighton and West Worthing. These cables are five in number and they had to be specially manufactured in continuous lengths of 2,183 yds., as no joins were permitted in the tunnel. The cables were laid in troughs on the tunnel wall, and the work was carried out at night.

The first stage of the extended scheme, reaching to Three Bridges and Reigate, is expected to be working with electric trains by next Summer, while the whole scheme to Brighton and West Worthing is to be completed in 1933.

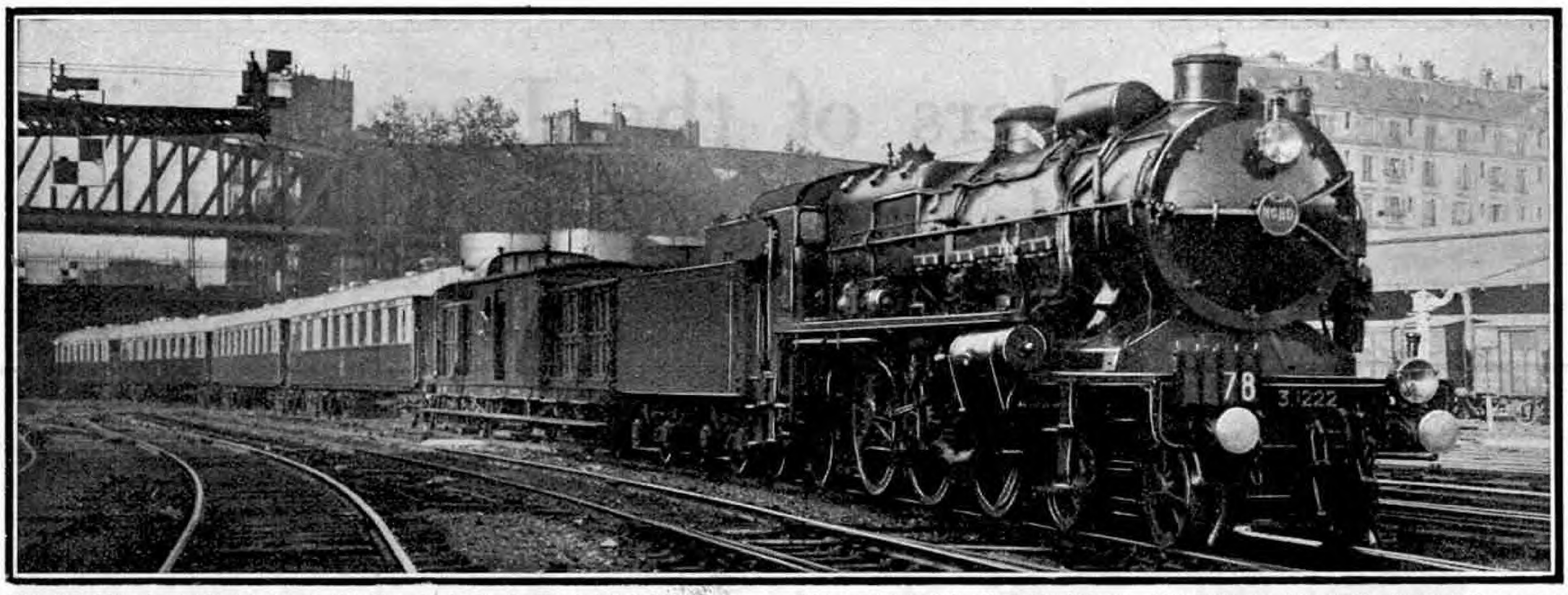
Southern Railway Locomotive News

Another engine of the 2–6–0 three-cylinder "U1" class has been sent from Eastleigh works into traffic. It is numbered 1905.

All the four-cylinder 4–6–0 engines of the "T.14" class have now been rebuilt at Eastleigh. They were originally built to the designs of Mr. Dugald Drummond for the former L.S.W.R. Five of them—Nos. 443 to 447—appeared in 1911, and a further five—Nos. 458 to 462—in 1912. They were commonly called the "Paddle Box" engines on account of the large splashers over the driving wheels. In rebuilding, Mr. Maunsell has removed the heavy splashers and raised the footplates, thus giving easier access to the coupling and connecting rods and other moving parts. He has further improved the engines by fitting Maunsell superheaters and Wakefield mechanical lubricators.

A "Royal Scot" and the Royal Train

When the King returned to London from Balmoral on the morning of Tuesday, 29th September, the Royal train arrived at Euston four minutes ahead of scheduled time. It had been brought from Crewe by the "Royal Scot" locomotive No. 6121, *"H.L.I.,"* which, both in appearance and efficiency, was in perfect condition. In the course of the previous week this engine had done some excellent running while being "tuned up" in readiness for working the Royal train. On the preceding Saturday, for instance, it had worked the *"Mid-Day Scot"* from Crewe to London and gained ten minutes on the booked timing. Trouble with a passenger had occasioned a delay which made the train six minutes late out of Crewe. Slacks were made at Stafford, Polesworth, Rugby and Blisworth, yet Euston was reached four minutes ahead of time, the 158 miles from Crewe having been covered in exactly 165 minutes. Smart work had therefore been performed, for although the gradients are for the most part easy, slacks considerably affect running.



The "Golden Arrow" express on the Chemin de fer du Nord, headed by a compound locomotive of the "Pacific" type. The train number on the front of the engine is clearly seen. This number also is readily visible at night, when the figures are illuminated.

Works Reorganisation on L.N.E.R.

In consequence of reorganisation, the building of new locomotives on the L.N.E.R. is now confined to the works at Doncaster and Darlington, which are capable of turning out 100 locomotives a year. The works at Stratford, Gateshead, Cowlairs and Inverurie are now used for repairs only.

New carriage stock is now built at York, Doncaster and Dukinfield; wagons are built at Doncaster, Darlington and Dukinfield. These works are able to construct 500 carriages and 10,000 wagons a year.

Darlington works are engaged at present on some 0–6–0 goods engines of the "J39" class and the fifteen passenger engines of the 4–4–0 "Shire" class, which were included in the 1930 programme, are also being proceeded with.

Pannier-Tank Engines for the G.W.R.

The new locomotives recently put into service by the G.W.R. have included some further 0–6–0 goods pannier-tank engines, built by Messrs. W. G. Bagnall Ltd., and numbered 8737 to 8749.

Fast Runs by Pneumatic-Tyred Rail-Car

One of the new "*Michelines*," a rail-car having pneumatic tyres, has recently done some smart running during trial runs made on the State Railways of France from Paris to Deauville and back. On the outward journey the distance of 137 miles was covered in 2 hrs. 14 min., which is 21 min. less than the time of the fastest train between these points. This fine record was even beaten on the return journey when only 2 hrs. 3 min. was taken, giving an average speed of 66 m.p.h. The speed of the best ordinary express averages only 53 m.p.h.

G.W.R. Eight-Wheeled Tender

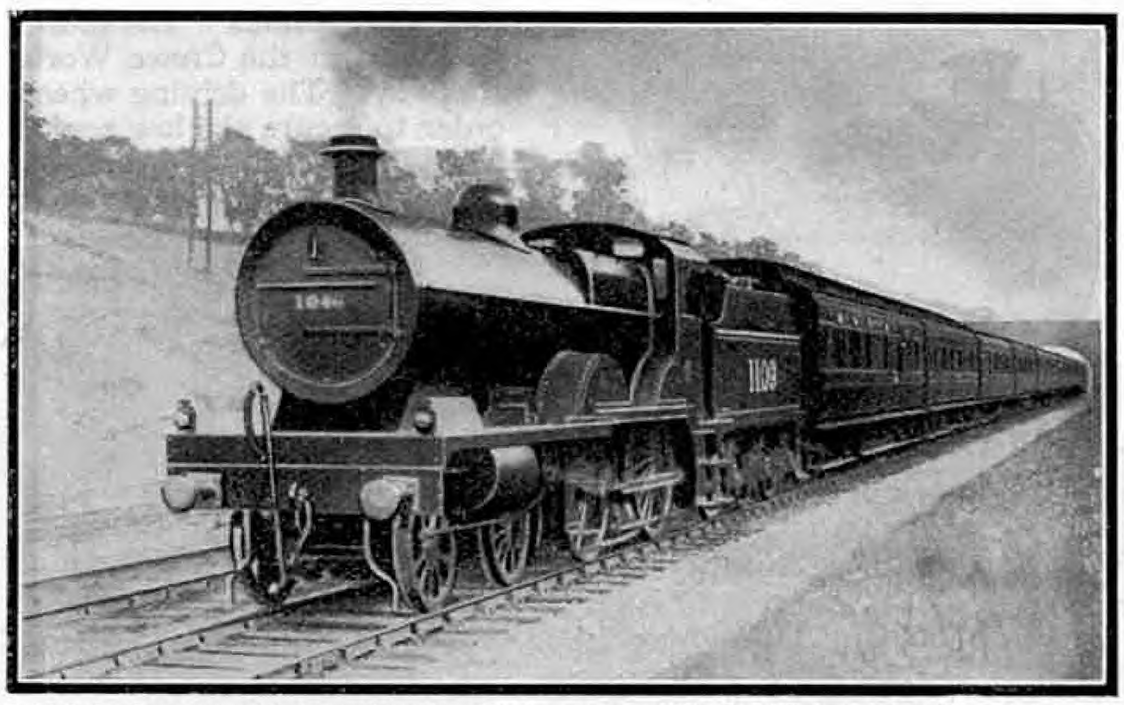
One of the G.W.R. "Hall" class locomotives, No. 5919, "*Worsley Hall*," is provided with an eight-wheeled tender with rigid outside frames. This is not the first eight-wheeled tender on the G.W.R., as the former 4–6–2 locomotive, "*The Great Bear*," had an eight-wheeled bogie tender. This had frames inside the wheels similar to those of many S.R. tenders.

Canadian Railway's Coal Bill

Coal is the largest single item purchased by the Canadian National Railways. The yearly bill is approximately £6,000,000 and the quantity of coal used is 6,000,000 tons.

Milk Tank for Road and Rail

A milk tank that carries 2,000 gallons of milk and can travel on road or rail has been introduced on the Southern Railway. The tank is of metal and is lined with glass. Small rubber-tyred wheels enable it to run on the road, on which it is hauled by a tractor from the depot at which it is filled to the nearest railway station. There it is hauled on to a special truck by means of a rope and pulley. The wheels of the tank fit into grooves on the truck and special scotching apparatus and chain fixtures help to keep the load steady en route. The general use of such tanks would greatly expedite the carriage of milk and further developments will be awaited with interest.



L.M.S.R. Compound locomotive No. 1046 running with the tender of No. 1109 coupled to it. This was one of the first compound locomotives built after grouping. The train is a down Scottish Express near Mill Hill on the former Midland main line.

Swiss Electric Railways

Owing to the ready availability of hydro-electric power the results of electrification of the railways of Switzerland have been very favourable. The maintenance of an electric motor vehicle is less costly than that of a steam locomotive, and analysis shows that the traffic has been worked at less cost than if steam power had been used. The Federal Railways own 364 main line electric locomotives.

New Signal Box at King's Cross

A large new signal box has been erected at King's Cross Station, London. It occupies a central, commanding position between Nos. 5 and 6 platform lines, a few yards beyond the platform ends. It will control the whole of the yard and station. The locking-frame is all-electric and contains 232 levers.

Replica of "*Rocket*" for American Museum

An accurate replica of George Stephenson's celebrated locomotive, the "*Rocket*," has been constructed by Robert Stephenson and Co., of Darlington, for the Museum of Science and Industry, Chicago, U.S.A.

Famous Locomotive in Liverpool Station

The historic locomotive "*Lion*," which was built for the Liverpool and Manchester Railway in 1838, has been placed on permanent exhibition at Lime Street Station, Liverpool, where it has been given a permanent position between platforms Nos. 3 and 4. In 1859 the "*Lion*" came into the possession of the Mersey Docks and Harbour Board, by whom it was employed as a pumping engine until August, 1928. It was then presented to the Liverpool Engineering Society (whose property it still remains) in order that it might be preserved for the City of Liverpool. It was restored at Crewe Works last year for the Liverpool and Manchester Railway centenary celebrations, at which, running in steam and drawing a train of old-time design, it was one of the chief attractions.

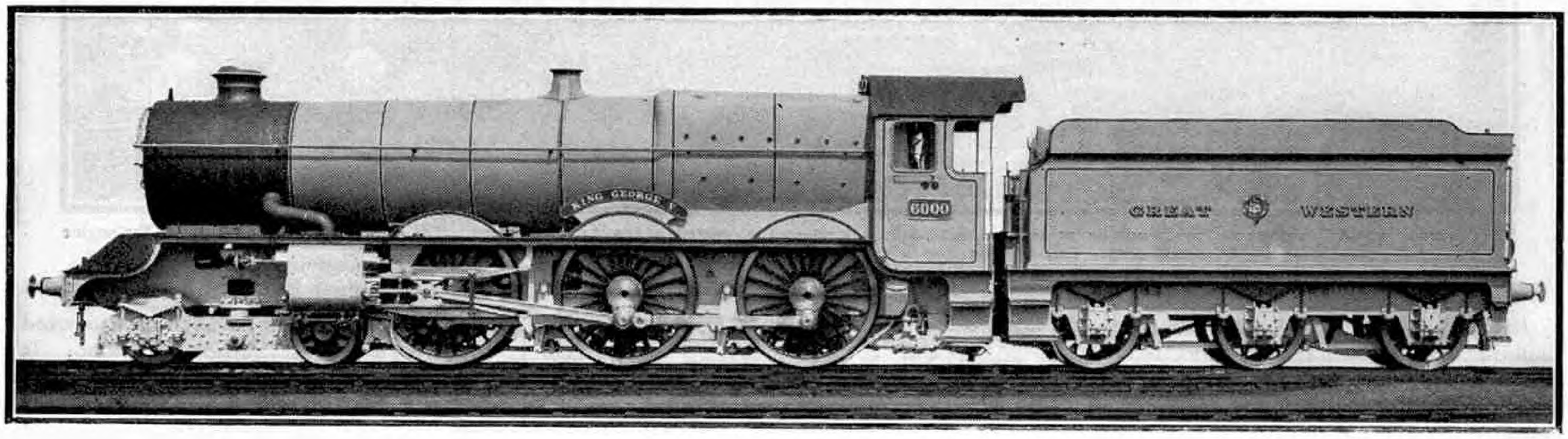
A full account of the wonderful career of this famous locomotive was given on page 684 of the "*M.M.*" for September, 1930.

Rolling Stock in Pre-Group Colours

Although the operation of our railways under the grouping system has proceeded now for nearly nine years, it is still possible to see rolling stock finished in pre-grouping styles. Thus wagons of the L.N.W., G.C., N.S., G.E., G.N., G.S.W., Midland and Caledonian railways have been observed recently in the Liverpool district. Coaching stock in the colours of the former Lancashire and Yorkshire Railway also may be seen occasionally.

Some Members of the Loco Family

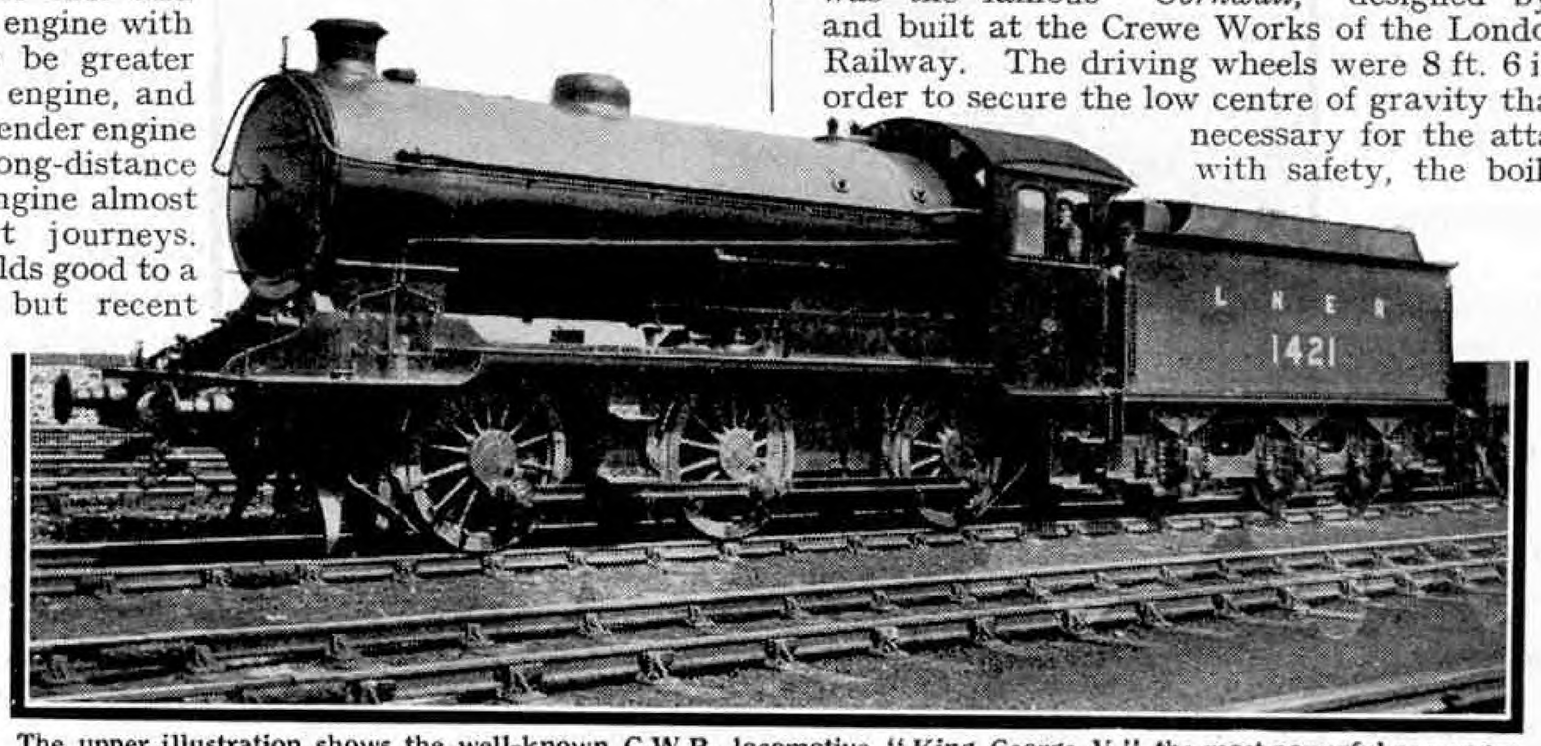
How Special Types Have Been Developed



IN the early days of the steam locomotive, as in the early days of all inventions, there was no specialisation. Cugnot and Murdock with their road locomotives, and Trevithick with his first railway locomotive, were concerned almost entirely with the problem of constructing an engine that would "go." In this they succeeded, but many years elapsed before engineers began to design special types of locomotives for different purposes.

The gradual development of the railway locomotive from its original crude and inefficient condition has been described before in the *"M.M.,"* and need not now be repeated. We are concerned at the moment only with the modern locomotive, and with the various considerations that affect its design.

Railway engines may be divided broadly into two classes—tender engines, which have coupled to them a separate vehicle to carry the necessary fuel and water, and tank engines, which have not a separate vehicle attached, but carry their own supplies. It is obvious that the fuel and water capacity of the engine with separate tender must be greater than that of the tank engine, and until recent years the tender engine was employed for long-distance traffic and the tank engine almost exclusively for short journeys. The distinction still holds good to a considerable extent, but recent developments in tank engines have brought the two classes nearer together.



The upper illustration shows the well-known G.W.R. locomotive "King George V," the most powerful passenger engine in Great Britain. It represents perhaps the most advanced development of the 4-6-0 type of normal design. Below is L.N.E.R. No. 1421, belonging to the "J38" Class of 0-6-0 locomotives. These fine examples of modern six-coupled goods and mineral locomotives were built at Darlington to the designs of Mr. H. N. Gresley.

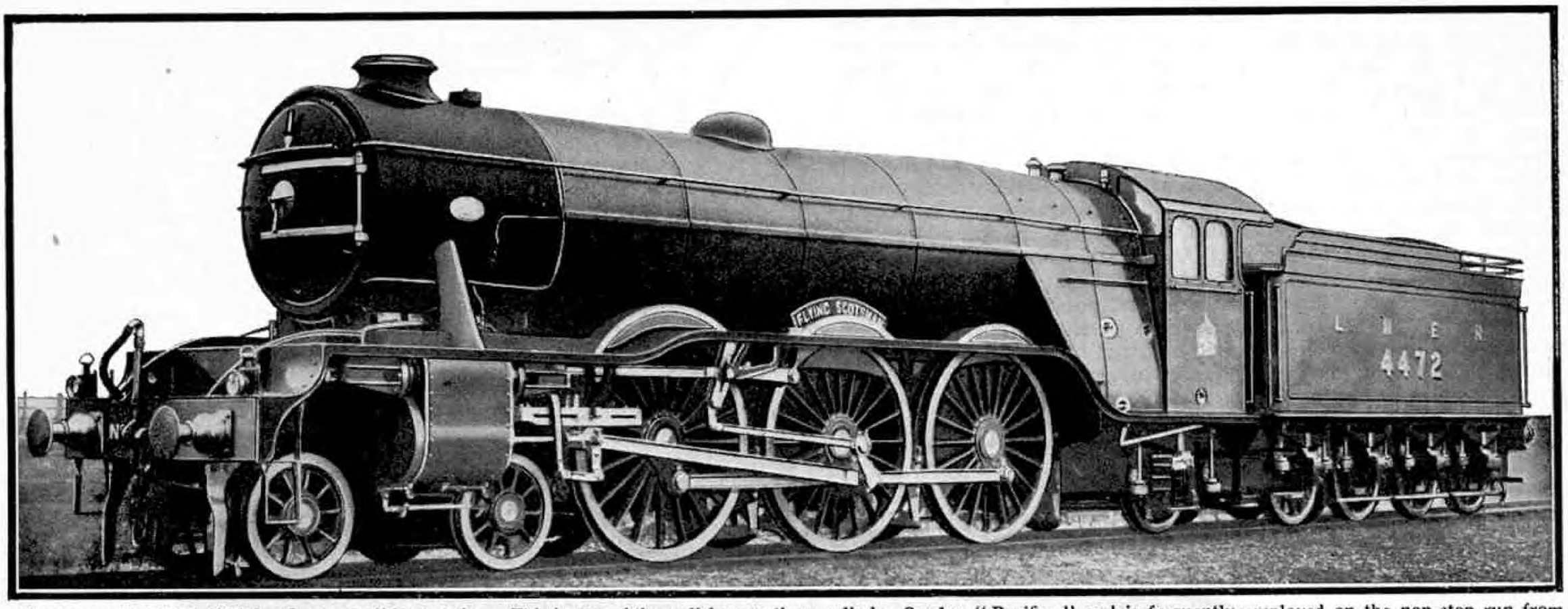
The tender engine is clearly ideal for very long runs. The capacity of the tender of a main line engine may be anything between 3,000 and 5,000 gallons of water and five to nine tons of coal, and thus journeys of 350 miles or more become possible on one filling up. Tenders of such size, when full, are very heavy, and this weight has to be hauled by the engine in addition to the weight of the train behind. The hauling of this weight is justified in the case of long-distance expresses but it is utterly uneconomical when short distances only are to be run, and here the tank engine scores heavily.

In addition to carrying no more fuel and water than is necessary for its work, the tank engine possesses the important feature of being able to run equally well backward as forward, thus being independent of the turntable. A tender engine is capable of running backward, but when doing so it has to push its tender before it, which makes fast running undesirable if not altogether unsafe. The tank engine has no such disability, and in addition its driver has as clear a view when running backward as forward, which is not the case when there is a tender in the way. Thus a tank engine has greater flexibility and this, in conjunction with its economical running, makes it the best type for suburban and other short-distance work and for shunting and similar purposes.

Many other considerations must be taken into account in settling the type of engine required for any particular work.

In dealing with tne design of engines for different purposes, the number, size, and arrangement of the wheels carrying the engine are of vital importance. The early types of engines for passenger work were mostly what are known as "single wheelers," that is engines with one pair of driving wheels. Between the years 1840 and 1850 some extraordinary locomotives of this type were designed, characterised by enormous driving wheels. Among these was the famous *"Cornwall,"* designed by Francis Trevithick, and built at the Crewe Works of the London and North Western Railway. The driving wheels were 8 ft. 6 in. in diameter, and in order to secure the low centre of gravity that was then considered necessary for the attainment of high speed with safety, the boiler was slung beneath the driving axle. The locomotive was subsequently rebuilt with the boiler placed in the usual position, in which form it still survives. It has now retired from active service, however, and is preserved at Crewe Works. It was exhibited at the centenary celebrations of the Liverpool and Manchester Railway held at Liverpool last year. Driving wheels 10 ft. in diameter were tried on the G.W.R., but apparently without much success; but the old Bristol and Exeter Railway had some double bogie single-driver tank locomotives with 9 ft. wheels, which ran well for several years. Gradually it was found that satisfactory speeds could be obtained quite easily with wheels of more reasonable size, and by about 1850 the day of freak engines was past. From then onward the development of engines was along proved and standard lines.

Conspicuous among the "single wheelers" of the following years were the famous 4–2–2 Stirling "eight-footers," so called from the size of their driving wheels. These were designed by Mr. Patrick Stirling, the locomotive engineer of the Great Northern



The famous L.N.E.R. "Flying Scotsman" locomotive. This is one of the well-known three-cylinder Gresley "Pacifics," and is frequently employed on the non-stop run from King's Cross to Edinburgh, a distance of nearly 400 miles. The wide fire-box with which these engines are fitted is clearly shown in the above photograph.

Railway. Their efficiency was undoubted and their handsome appearance attracted widespread attention. Trains were considerably lighter then than they are now and the "eight-footers" put up some striking performances on long journeys. This was particularly the case in the closing years of last century, when the Stirling "eight-footers" achieved great distinction in the railway race from London to the North between the trains of the East and West Coast companies. The first of these engines by the way, ran well over a million miles, and is now preserved in the Railway Museum at York. The heaviest of the type weighed 90 tons with its tender, while its successor, the "*Flying Scotsman*" weighs no less than 150 tons.

In the following years there was a great increase in the loads that engines were called upon to draw. In the case of passenger traffic the increase in the weight of trains was accounted for by the more massive construction of the coaches. This has led to an immense improvement in the accommodation for passengers, including the provision of such luxuries as corridor coaches, dining cars and sleeping cars. The latest type of coach used for the famous "*Flying Scotsman*" weighs approximately 35 tons, so that a 12-coach train weighs well over 400 tons. As an illustration of the increase of engine power it may be noted that only 30 years ago a 200-ton express was regarded as heavy, and two locomotives were thought necessary to draw a 300-ton train.

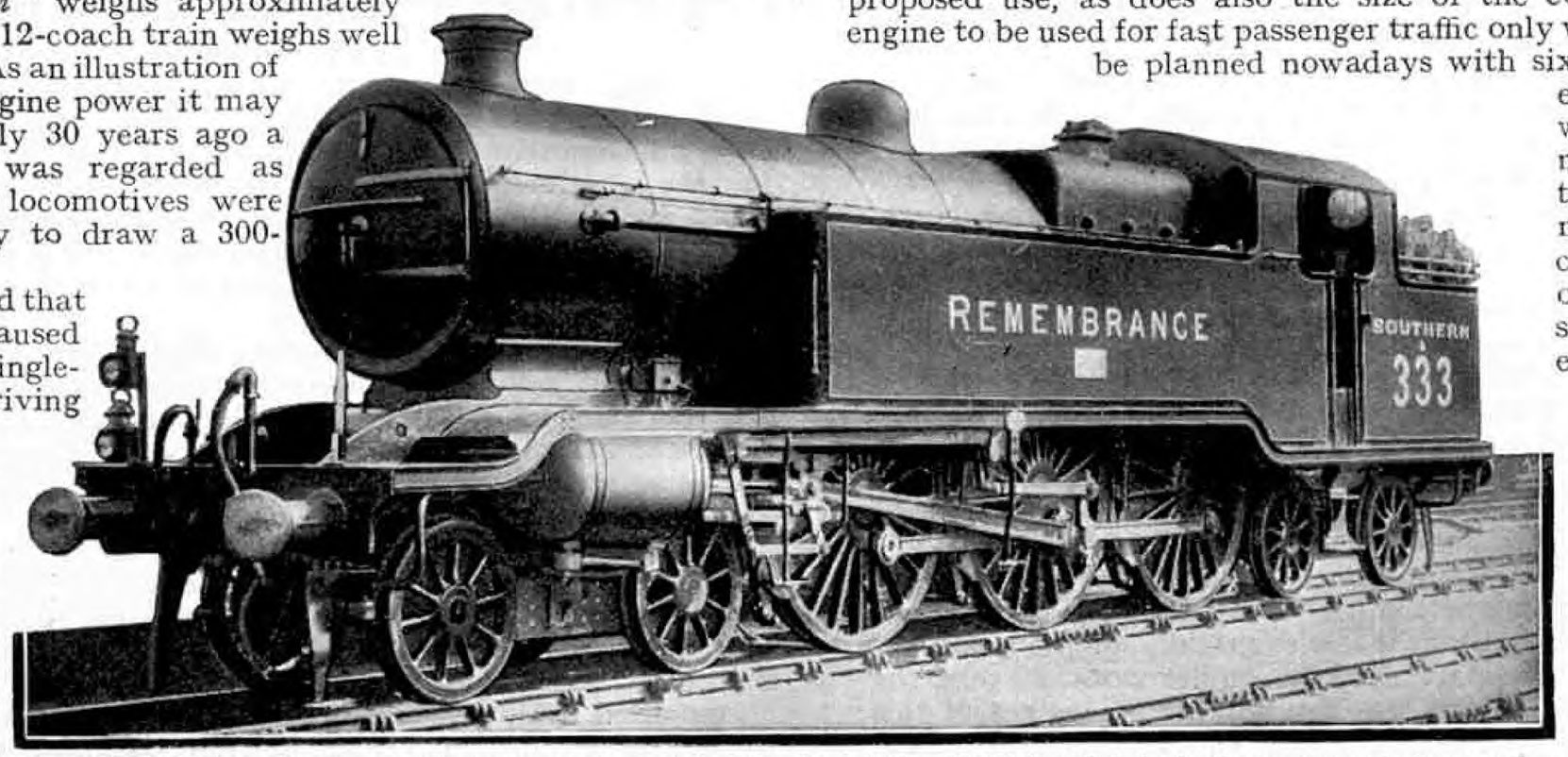
It was soon found that excessive load caused wheel-slip in single-wheelers. The driving power of a locomotive depends entirely on the grip of its driving wheels on the rails, and while the adhesion between the smooth surfaces of the rail and the wheel may be increased by the use of sand, the only satisfactory method in practice is to increase the weight bearing down on the driving wheel.

This increase has its limits, however. Until recently the maximum safe axle weight allowed in Great Britain was 20 tons, or 10 tons on each wheel. In the latest express designs, however, it has become possible to exceed this figure, owing to the use of improved methods of balancing and the employment of alloy steel for the motion parts, resulting in a reduction in weight. The G.W.R. "King" locomotives have an adhesion weight of 67 tons 10 cwt., distributed over the three coupled axles; and similarly the S.R. "Schools" class 4–4–0 locomotives carry a load of 42 tons on their driving axles.

In the early days of locomotives another method of procuring greater adhesion was adopted. This was the use of a second pair of driving wheels of exactly the same size as the first pair, and coupled to them as are the driving wheels in the well-known 4–4–2 "Atlantics," a type that derives its name from the fact that it was first used on the Atlantic City Express from New York. From this it was a natural development to couple still more wheels together, in order to obtain the utmost possible adhesion, and also greater stability; and thus the 2–6–0, the 4–6–2 and other similar types came into use.

The function of the remaining wheels is to assist in carrying weight, and their number and position is settled for any engine by the design of boiler and firebox adopted and the total weight of the engine. The "idle" wheels, as they are called, are either leading or trailing wheels, the names referring to their position with regard to the driving wheels. The provision of leading wheels is absolutely essential for any engine designed for express work, as they fulfil an important duty in "feeling" for the track, so rendering high speeds safe.

The actual arrangement of the wheels of an engine depends on its proposed use, as does also the size of the coupled wheels. An engine to be used for fast passenger traffic only will almost certainly be planned nowadays with six coupled wheels to enable it to cope with the weight of modern express trains. As it will make long runs, a considerable weight of fuel will be necessary, so that an engine with a tender is required. Further, the weight of the boiler and firebox usual for this type of work suggests six "idle" wheels, the best arrangement for which will be a four-wheeled bogie in front with two trailing wheels. This is, of course, the arrangement of the well-known 4–6–2 "Pacific" engines, the famous "*Flying Scotsman*" being an example of this type.



"Remembrance," a Southern Railway express tank locomotive having the "Baltic" or 4-6-4 wheel arrangement. Locomotives of this class are employed on the fast and heavy trains between London and Brighton. It was named in memory of the employees of the Brighton section who fell in the Great War.

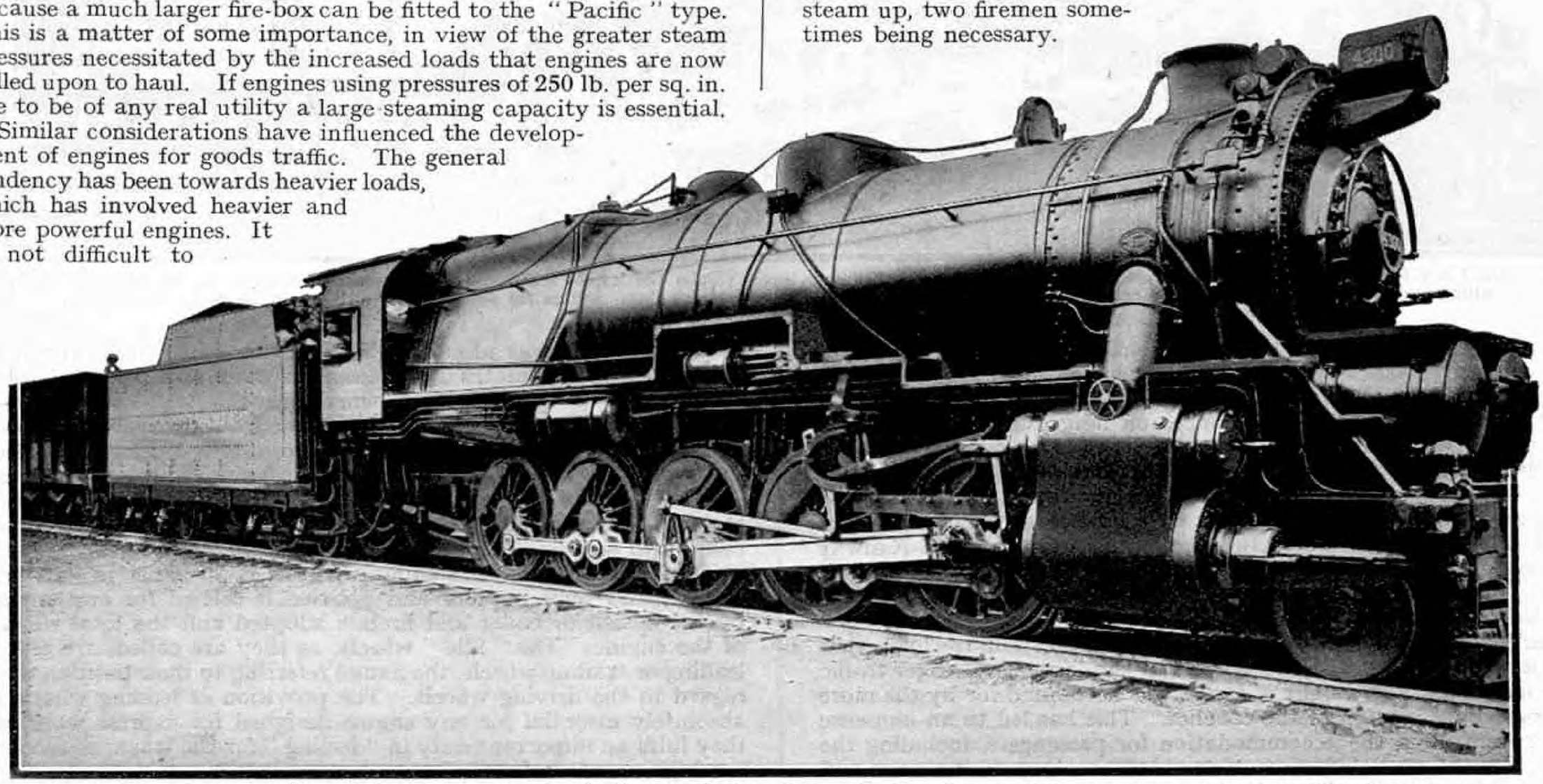
It is of interest to note that the first engines of this type were built in the United States to the design of the locomotive engineers of the New Zealand Government Railways, while a similar engine was built independently for the West Australian Railways. The name "Pacific" indicates the origin of the type and also its association with the 4–4–2 type.

Practically all fast passenger express engines now constructed have six coupled wheels, as the modern express train loads are beyond the powers of the 4–4–2 "Atlantics," which for years were the standard engines for work of this kind. Another type of engine

with six coupled wheels in common use for express work is the 4–6–0, and engines having this wheel arrangement are commonly referred to as "ten-wheelers." Among them are the famous G.W.R. "Kings." The most famous example of this class is "*King George V*," which is one of the most graceful locomotives ever built. It was sent by the G.W.R. to the United States in 1927, shortly after its construction, to take part in the "*Fair of the Iron Horse*" that was held in connection with the centenary celebrations of the Baltimore and Ohio Railroad. During its stay it was greatly admired by railway experts and the general public alike. Its symmetrical design has influenced American locomotive designers to some extent, and several recent American locomotives show British tendencies in general outline and finish.

The 4–6–0 type is losing favour with many designers, however, because a much larger fire-box can be fitted to the "Pacific" type. This is a matter of some importance, in view of the greater steam pressures necessitated by the increased loads that engines are now called upon to haul. If engines using pressures of 250 lb. per sq. in. are to be of any real utility a large steaming capacity is essential.

Similar considerations have influenced the development of engines for goods traffic. The general tendency has been towards heavier loads, which has involved heavier and more powerful engines. It is not difficult to realise the type of engine required for hauling heavy goods trains when high speed is unnecessary. As the main thing is to get along with a huge load, the number of coupled wheels may be increased with advantage to eight or even more. In fact all the wheels may be coupled together, so that the whole of the weight of the engine is available for adhesion. The diameter of the wheels may be reduced from 6 ft. 9 in., a usual size for passenger express engines, to 4 ft. 6 in. or 5 ft., since small wheels have the advantage of giving more hauling power in covering any given distance, at the expense of speed which is not essential for this traffic.



A huge freight locomotive of the Pennsylvania Railroad of America. It has 10 coupled wheels, and is therefore known as a "Decapod." A specially large tender is provided in order to provide for the needs of the enormous boiler and fire-box.

Engines with eight wheels coupled, 0–8–0, are generally referred to as the "Mineral" type, their original purpose being the haulage of slow but heavy coal and mineral trains. With a leading pair of small wheels the type becomes 2–8–0 or "Consolidation," another name derived from American practice. The first engine of this type was christened "Consolidation" to commemorate the fusion of two American Railways. It was introduced to haul coal traffic over a heavy section of road on the Lehigh Valley Railroad and proved so conspicuously successful that it was eventually adopted, and the name with it, as the type best fitted for similar work, all over the world. A remarkable feature was the number of engines of this type built during the War, both in Great Britain and in America. The number required was so large that the plant of the famous Baldwin Locomotive Company in Philadelphia was organised for an output of 300 a month!

A further development from this type is the 2–8–2 or "Mikado" type, now handling with great success the heavy coal trains between Peterborough and London on the L. & N.E.R. This type of locomotive owes its origin to the inferior quality of the coal formerly available for the Japanese railways. This necessitated a larger grate area and a bigger fire-box than was possible on the "Consolidation" type, and these requirements were met by setting a wide fire-box behind the driving wheels and providing a trailing truck to give the necessary extra support.

Other special requirements, either greatly increased loads or formidable inclines, have produced many types of engines with more wheels. Thus the 4–8–0 "Mastodon" was altered to suit the conditions met with on the Natal railways by adding trailing wheels, the new type being known as the "Mountain." As in the case of the "Mikado," the object was improved steaming capacity. The 4–8–2 type is now commonly used for express passenger work in America.

The 0–10–0 "Decapod" was introduced as long ago as 1882, when the rails of a long gradient over the mountains on the Southern Pacific Railway were increased in weight from 50 lb. per yard to 62 lb. The President of the company remarked that he would like to see an engine representing as great an advance in size and power over those existing as the new rails did over the old ones. The result was a tremendously heavy and powerful 4–10–0 locomotive known as "*The Guv'nor*," that unfortunately suffered a similar fate to the steamship "*Great Eastern*," and for similar reasons. The main difficulty was to keep steam up, two firemen sometimes being necessary.

"*The Guv'nor*" was undoubtedly premature, and even to-day it may be said that "Decapods" are only suitable for special work on steep gradients with heavy loads. The Great Eastern Railway tried a locomotive of this type many years ago for suburban work, and the experiment showed that the locomotive was capable of more rapid acceleration than had been thought possible. It was too heavy for the bridges, however, and was therefore dismantled, parts of it being used in the construction of a 0–8–0 tender locomotive that eventually was scrapped.

The grip on the rails given by the coupled wheels of a "Decapod" makes it very suitable for banking, and an engine of this type is used for this purpose on the Lickey Incline, near Bromsgrove. On American railways, where restrictions on the size of engines are less harassing, more use is made of engines of this type, and there 2–10–2 goods engines are more common.

The magnificent engine illustrated on this page, for instance, is used to haul incredibly long and heavy freight trains through mountainous sections on the Pennsylvania Railroad. On these sections wonderful curves and loops have been constructed in the search for easier running, but there still remain gradients to be surmounted. This is done successfully both by ten-coupled engines of the type illustrated and by the standard 4–8–2 passenger express engines of that railroad.

To distribute the increased weight of engines and to enable curves to be negotiated easily, an articulated type was introduced such as the "Fairlie," the "Mallet" and the "Garratt." These engines have usually been required either for heavy banking or for work on railways in mountainous country, as the articulation principle allows for the provision of a large number of driving wheels. Thus we find "Garratts" with 16 driving wheels, arranged in two sets of eight. Four pairs of cylinders are fitted and supplied with steam from a common boiler. Engines of this class are in use in many parts of the world, such as South Africa and Queensland, where severe gradients exist, that have to be surmounted with long and heavy trains. The type is also in use in Great Britain. The L.N.E.R. possess one example having a 2–8–8–2 wheel arrangement, used for banking services on the Worsboro' branch. This locomotive was built in 1925 and was the first "Garratt" locomotive



A maze of steel rails! Modern methods of steel construction have made possible huge sidings such as the one depicted here, with elaborate systems of points and crossings all working with perfect accuracy.

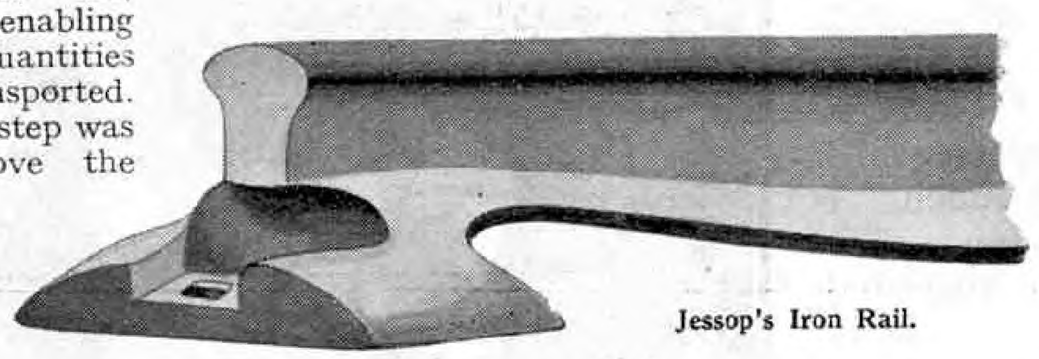
to operate on a British railway. Previous to this however, there had been a 0–4–4–0 "Garratt" locomotive working at a copper mill in South Wales, but this was, of course, a much smaller engine. The L.M.S.R. have 33 of the 2–6–6–2 variety at work on main line coal trains.

In addition to these specialised locomotives it is also necessary on most railways to provide engines for all-round work and mixed traffic. An engine that has proved of great value for this purpose is the 0–6–0 type which will never be excelled for all-round usefulness. The type is termed "Goods" in a general way although its activities are by no means confined to this kind of work. The addition of a leading pony truck made possible a longer boiler and heavy outside cylinders and so developed the 2–6–0 or "Mogul" type, originated in America and imported into England in the late "nineties" of last century when there was a shortage of engines on the Great Northern, Great Central and Midland Railways. Examples of the type, however, had been at work on the Great Eastern Railway as early as 1879 but they did not last very long, being withdrawn during the years 1885-87. The Midland and South Western Junction Railway also possessed two examples built before the American engines were introduced. Each of the four group railways has now a large number of locomotives of this type extremely well suited for mixed traffic working.

Tank engines have followed a similar course of development to that of tender engines. So long as this type of engine was confined almost exclusively to short-distance work the first essential was power rather than speed, for with the kind of passenger train worked by these engines good starting is essential. Accordingly the earlier tank engines had small wheels. A striking development has been the construction of large tank engines for express passenger work. On the Southern Railway for instance 4–6–2 and 4–6–4 or "Baltic" tank engines have been used on the journeys of 50 or 60 miles from London to the towns on the South Coast. These are genuine express engines capable of running at very high speeds. Nor should the G.W.R. "County" tank locomotives be forgotten, for these are capable of notably fast running. The L.N.E.R. and the L.M.S.R. have 2–6–2 and 4–6–2 tanks that are well known for their smart work. The L.M.S.R. 2–6–4 tank locomotives have made a name for themselves on fast long runs, and this wheel arrangement is now being added to by the S.R. for goods work.

The Development of Steel Rails

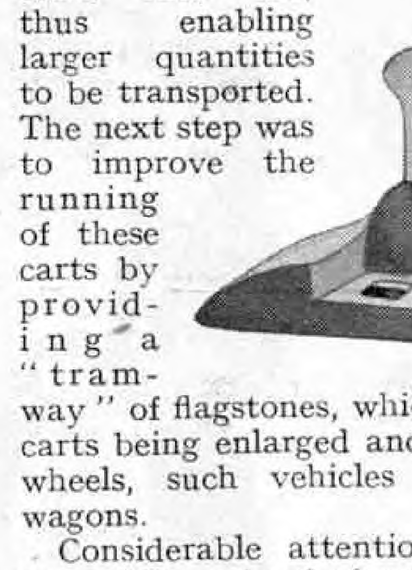
THE iron rail may be said to have developed to meet the requirements of the English coal industry, particularly in the northern counties. When the coal is brought to the surface it is immediately necessary to transport it to a place of shipment. At first this was done by carrying it on horseback in sacks or otherwise, but later, two-wheeled carts came into use, thus enabling larger quantities to be transported. The next step was to improve the running of these carts by providing a "tramway" of flagstones, which again led to the carts being enlarged and mounted on four wheels, such vehicles being known as wagons.



Jessop's Iron Rail.

Considerable attention was next paid to making easier the haulage of the wagons, and it was not long before a form of wooden rail was introduced. These rails consisted of pieces of planking either laid parallel upon wooden sleepers or embedded in the ordinary track. The resulting decrease in friction enabled a single horse to draw a large wagon fully loaded.

It was found that the wooden rails quickly wore away and so thin iron plates were nailed to them to protect them. Later, cast iron rails were introduced to avoid trouble through the rotting of the wooden rails. A cast iron road of this kind was called a "plateway" on account of the plate-like form in which the rails were cast. The men who laid down the track were known as "platelayers"—a name that continues to be used to-day.



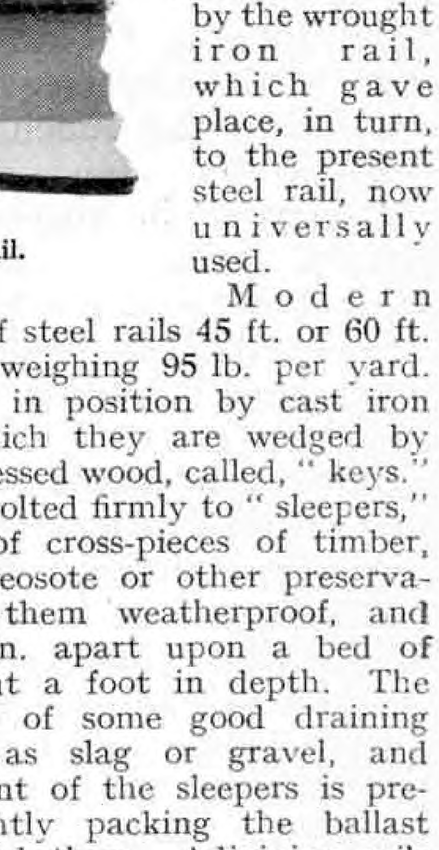
Section of Flanged Wagonway.

In 1789 William Jessop built a railway at Loughborough, using a cast iron edge rail and wheels with an inner flange. Jessop's rails were cast with a kind of foot, through which they were spiked down to cross-sleepers. This foot was abandoned later and the rails were placed on "chairs," the lines being braced with cross-sleepers.

The introduction of the locomotive made it necessary that rails of greater strength should be manufactured and consequently the cast iron rail was followed by the wrought iron rail, which gave place, in turn, to the present steel rail, now universally used.

Modern track is made of steel rails 45 ft. or 60 ft. in length and weighing 95 lb. per yard. These are held in position by cast iron chairs, into which they are wedged by blocks of compressed wood, called, "keys." The chairs are bolted firmly to "sleepers," which consist of cross-pieces of timber, treated with creosote or other preservative to make them weatherproof, and laid about 30 in. apart upon a bed of "ballast" about a foot in depth. The ballast consists of some good draining material such as slag or gravel, and lateral movement of the sleepers is prevented by tightly packing the ballast under and round them. Adjoining rails are connected by what are known as "fish-plates," the joints overhanging and not resting upon the sleepers. At curves the outer rail is raised a little above the level of the inner rail in order to counteract the centrifugal force of trains passing round the curve at high speed.

The most recent development is the use of steel sleepers. Experiments with these are now being made on portions of the tracks of the four British railway groups.



Flanged Wagon, 1765.

Behind the Scenes with the Chef

Lunch on the "*Union Express*," S.A.R.

THE "*Union Express*" pulled into the platform at Monument with much ostentation, as if indignant at having to stop so soon after leaving Capetown Docks, and above all at being denied the privilege of leaving from the main station. Slowly the gleaming line of articulated coaches came to a standstill, providing one with an opportunity of having a good peep at the spick-and-span interiors.

Feeling somewhat overawed, I sought out the Chief Steward and waited until he had finished giving some final instructions. At first glance he seemed to me to be no different from any other Chief Steward, but when he turned and asked courteously if there was anything he could do for me I changed my mind. After a few minutes' chat I felt I could hazard a good guess as to why he had been chosen for the onerous duty of attending to the needs of the passengers on "1 down."

"I want to be stowed away in the kitchen while you are serving lunch," I told him.

"Oh yes," he answered with a smile. "I have had a note about you from the District Inspector. Come along and see the Chef."

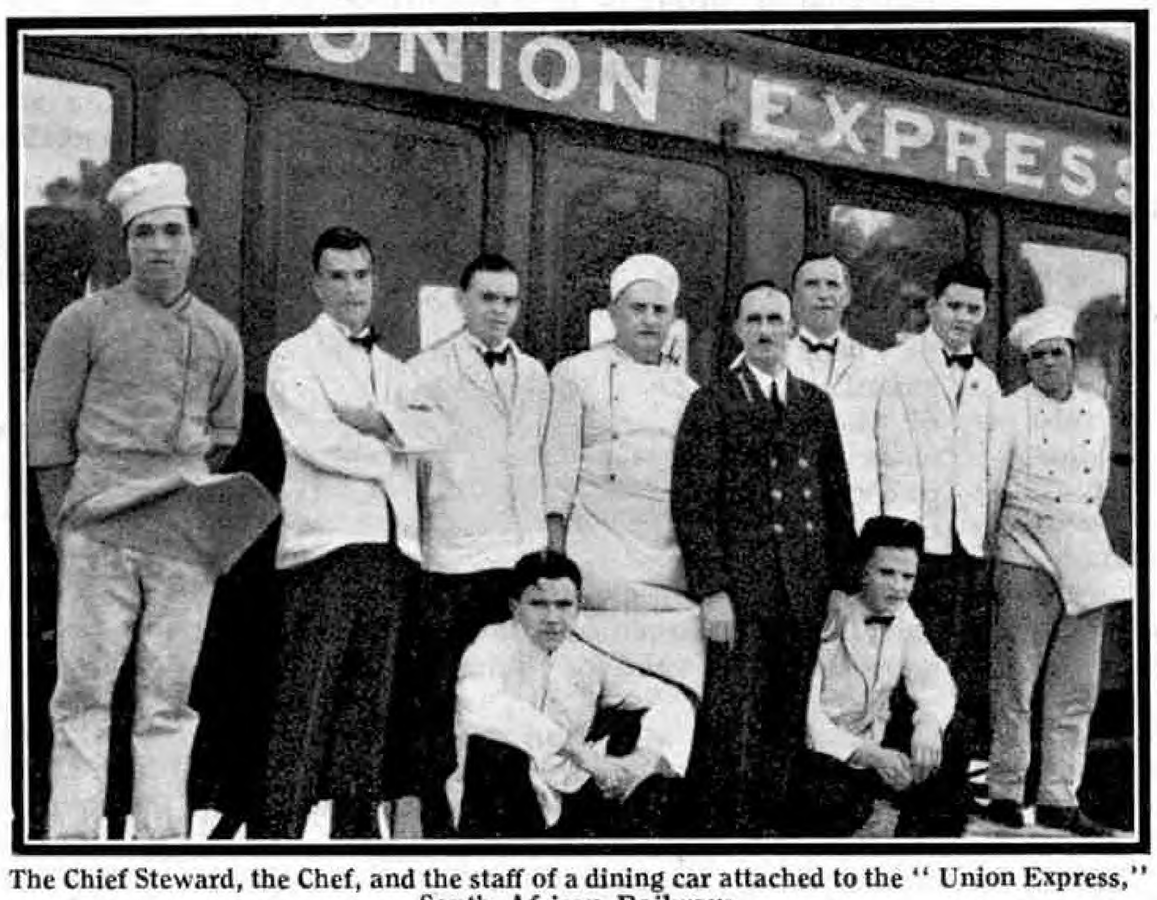
As we moved along down the corridor the Chief Steward sounded a note of warning. "I don't know how you're going to squeeze in," he said doubtfully. "The kitchen is quite small you know, and the Chef almost fills it himself."

"That's alright," I answered valiantly. "I don't mind a spell in the plate racks, or even in the refrigerator, so long as I am not in the way of anybody."

The Chef was standing at the entrance to the kitchen, and immediately I thought how absolutely typical of his profession he looked. I wonder why it is that all these custodians of the kitchen are so plainly stamped with the signs of their calling. Perhaps constant catering is responsible for the cheerful rotundity, the philosophical expression and the genial twinkle in the eyes. The Chef was clad from rakish cap to apron hem in the most neatly-laundered white, and he literally radiated good cheer—as good, I felt sure, as the fare he provided. If it may be assumed that nine-tenths of the meals that a chef eats are prepared by himself, then this one was certainly his own best advertisement!

I was introduced by the Chief Steward, who explained the object of my visit. The Chef's smile broadened still more. "Oh yes, we'll find room for you. Come along here about ten minutes before lunch is due to start."

We have all, at one time or another, been mystified at the sight of a clever conjurer producing in casual fashion a seemingly inexhaustible supply of articles from the inside of a borrowed hat. The production in quantity of choice viands from the cupboard-like compartment at the end of a dining saloon has always seemed to me quite as incomprehensible. Even now, although I have actually seen the feat performed, I know very little about the method of operation. My strongest impression is that the most valuable thing of all in that tiny swaying kitchen is space; it is as valuable as time is to the watchmaker. My wonderment, instead of being dispelled by the insight I was afforded into the inner workings, was deepened; and it is to me a remarkable thought that the same small but fierce battle against space, circumstances and conditions is being repeated, day in and day out, on the trains that are for ever traversing our far-flung network of rails. Even as I write a score of chefs are thinking out the details of to-morrow's breakfast!



The Chief Steward, the Chef, and the staff of a dining car attached to the "Union Express," South African Railways.

Agile and dexterous stewards were engaged in the task of setting the tables for lunch when I went along to take my place in the kitchen. It is given the name "kitchen," but what housewife would extend the dignity of this title to so confined a space? Consider the width of the compartment in which you travel in the train, and then subdivide that into the widths of a kitchen range, a gangway to move about in, and a table upon which to work. A cat that was unfortunate enough to be swung around here would certainly be in urgent need of every one of its nine lives! And yet in spite of these severe space limitations there is no apparent cramping, and never at any time is there the slightest confusion. Here, if anywhere, is to be found the ideal illustration of "a place for everything and everything in its place."

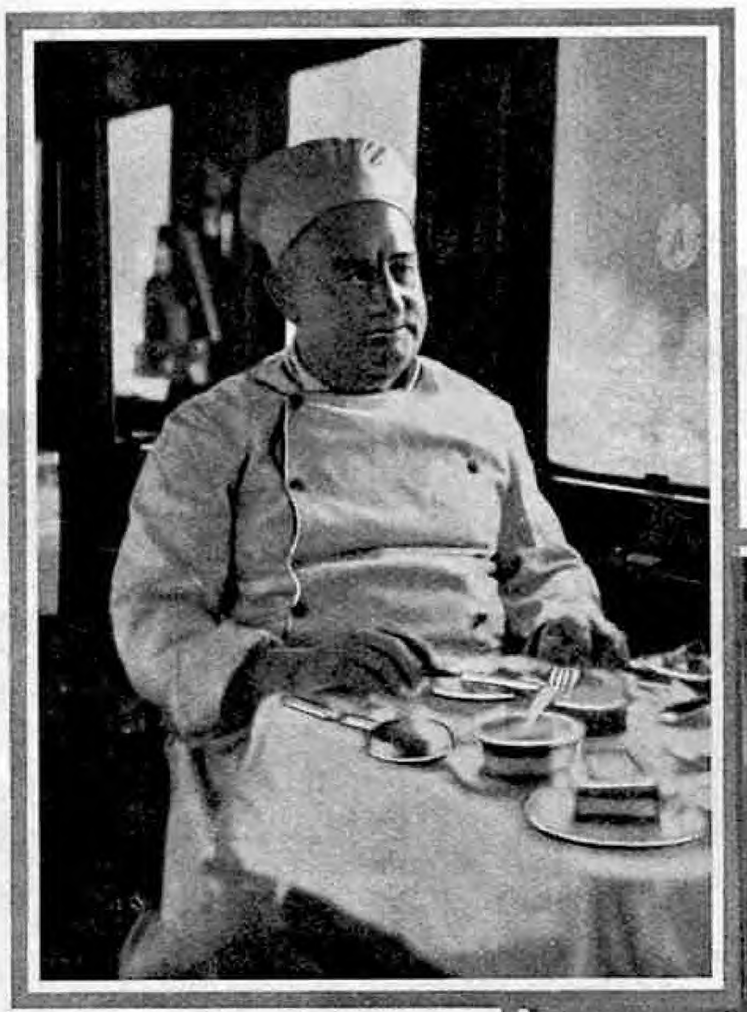
When I arrived the Chef was busy, as all chefs must be at such a time; but he cheerfully answered all my questions as he went about his work. I wanted to know what all those gleaming pots contained. Lids were lifted, savoury scents were released, and I was permitted to take a swift peep at the contents. The big pot contained the soup in tempting readiness to be served. Other pots held the vegetables, while in cabinets above, where they could be kept warm, were dishes with a variety of contents, including sliced boiled

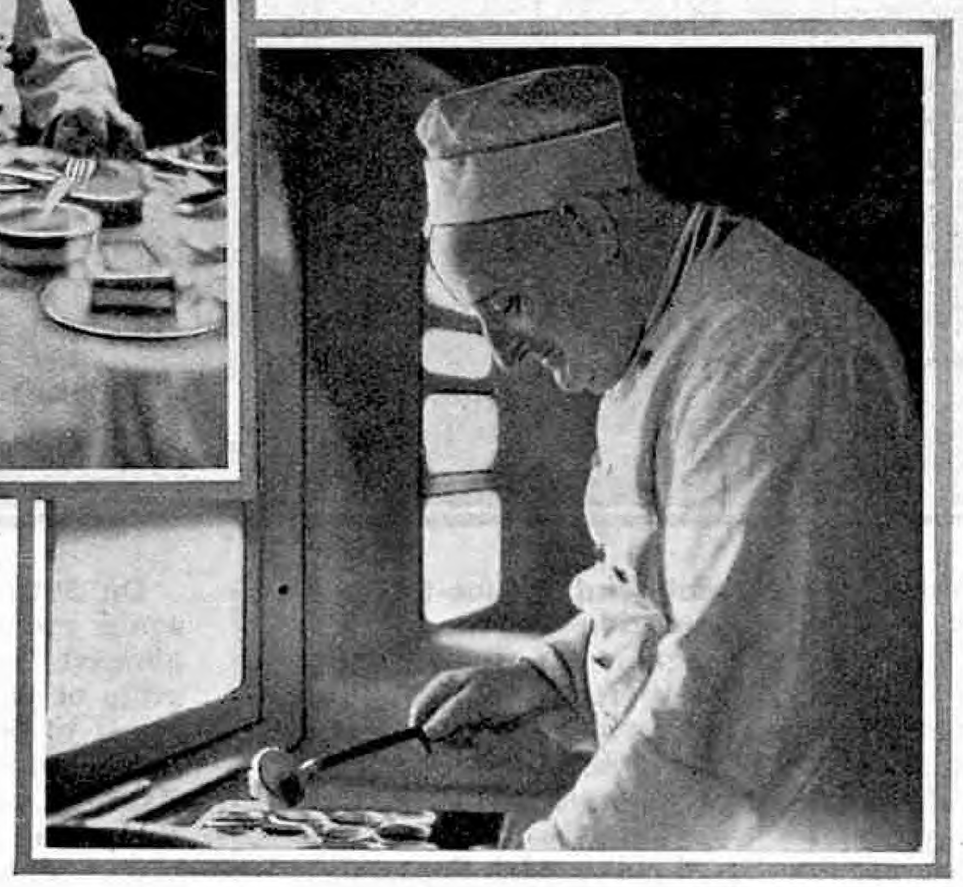
mutton just awaiting its caper sauce. Tea and coffee urns stood upon the stove and were as carefully tended as any of the dishes. The Chef was at work swiftly and easily slicing an assortment of cold meats, arranging the pieces tastefully on salvers and garnishing them with sprays of parsley.

Then the Chief Steward appeared in the doorway, carrying a bundle of meal tickets and apparently engaged in deep mental calculation.

"Chef," he announced at last, "I've got seventy for you—forty-five in the first sitting."

At the same moment a corridor steward poked his head through the hatch and ordered some lunches that were to be served in compartments. I got the tail-end of the order, ". . . old lady wants rice and no cabbage. One cold meats must be without any fat."





(Above) The Chef eats a lunch of his own cooking. (Right) The artist's touch! A delicate operation in preparing the "sweet" for dinner.

The Chef reached out for plates and commenced deftly to serve. Luncheon had commenced.

The mutton was still without its caper sauce, however, and in the short interval that followed I watched what I suppose is a very elementary culinary operation, but one that seemed to me a marvellous little piece of juggling with a pot, some butter, milk and flour, and a small bottle of capers.

Earlier on, the Second Cook had been busy arranging lobster mayonnaise. Now I noticed that he had left this job and was opening what appeared to be a miniature butchery at the far end of the kitchen. Already, before luncheon had really commenced, he was starting to prepare for dinner! The fourth occupant of the kitchen, the Scullion, was busy clearing away peelings, attending to the fire, and doing a host of other things.

"Do you ever run short of anything?" I inquired of the Chef.

"Very seldom indeed," was his reply. "Occasionally, of course, we have more than we expect. People often change their minds and decide to come in for a meal, and sometimes we get a batch of unusually heavy eaters. But we generally manage to get out of the difficulty somehow."

The Chef's remark about heavy eaters struck me as being very interesting. "Surely," I said, "one batch of, say, sixty people will eat practically the same quantity as another batch of the same number. The law of average ought to apply to eating the same as to everything else."

"Oh no, no!" was the emphatic reply. "Sometimes the difference will be as much as double. Why, I can remember . . . ."

But what the Chef could remember I was not destined to hear, for the first sitting had commenced and he had to bustle. He stooped to open an oven door. The train lurched. He burned his finger and gave vent to a very small and harmless "swearword." Now for the first time I realised how often, on account of the tiny space and the swaying of the vehicle, a train chef must burn himself. And the heat in the kitchen must be terrific at times.

I watched the Chef as he attended swiftly but without fuss to the orders which, by this time, were coming with monotonous regularity through the little hatch.

"Soup, three times; seven mayonnaise . . . soup twice; one tray of cold meats . . . one plate of vegetables and gravy, no cabbage . . . two soup; one mayonnaise; one steak and kidney, but with no kidney . . . macaroni, one; boiled mutton, one; and a vegetarian lady wants to know if she can order a poached egg . . . boiled mutton, one, with no caper sauce . . . one plate of lean ham; one mutton with plenty of caper sauce."

So it went on as though there were never to be an end. It was clear that we had a number of faddists on board, and I was interested to notice that there was never a remark or even a smile at even the queerest of fancies.

I talked to the Chef in snatches, and gathered that he had learned the culinary art "crossing the Herring Pond." He had worked in hotels, large and small, but he liked the life on the train. Curiously enough, when I asked him why, he was quite at a loss to explain. Catering for the traveller was his bent, although there is a great deal of difference between the pitch and roll of a great trans-Atlantic steamer and the interminable, jogging rhythm of train wheels.

He had become one of that little band working always behind the scenes, single members of which we, as travellers, may see occasionally mopping a damp forehead and taking a "breather" in the corridor. Their difficulties of working are enormous, but by way of counterbalance they have every facility that a highly-developed organisation can place at their disposal. One thing, however, no amount of organisation can provide; and that is a "back door" through which they can pop across the street and quickly obtain anything of which they may happen temporarily to be short. It is in this respect that the long practical experience of the chef plays such an important part, in enabling him to foresee accurately every detail of foodstuffs or equipment that will be required throughout the journey.

When I went through for my lunch I had no need to look at the menu; and when next I saw the Chef he was sitting down to a hearty meal of his own cooking.

For permission to print this interesting article, and also to reproduce the illustrations, we are indebted to the courtesy of the *"South African Railways and Harbours Magazine."*

The Fastest Train in the World

Record Runs by the G.W.R *"Cheltenham Flyer"*

By "Observer"



THE outstanding feature in the current winter time-tables of the British railways is the acceleration of the G.W.R. *"Cheltenham Flyer"* by which it regains the distinction of being the fastest train in the world. Its revised schedule allows only 67 minutes for the run of 77¼ miles from Swindon to Paddington and demands an average speed of 69.2 m.p.h. start to stop—a world's record of which Britain in general, and the G.W.R. in particular, may be justly proud.

As this new booking came into force on Monday, 14th September, just as the October number of the "*M.M.*" was going to press, it was not possible to do more in that issue than state briefly that on the first day of the new timing the train had arrived at Paddington seven and a half minutes early. Such a notable achievement is certainly worthy of a fuller record in the "*M.M.*" and the object of the present article is to supply additional details of that record-breaking run, together with some particulars concerning this now world-famous train.

The history of the train is remarkable. Throughout its career it has been to the forefront on account of its fast schedules. It does not travel the long distances or possess the special rolling-stock which distinguish some other famous trains, but it certainly can claim to have in a pre-eminent degree that which gives true distinction to an express train, and that is *speed*.

In pre-war days the Cheltenham Spa and London express ran non-stop from Kemble to Paddington—91 miles in 103 minutes. When normal services commenced after the War, a stop at Swindon was inserted and 85 minutes allowed for the 77¼ miles to Paddington. On 9th July, 1923, this was reduced to 75 minutes, requiring an average speed of 61.8 m.p.h., and making it the fastest start to stop express in Great Britain. On the day when that new timing came into operation, a very smart run was made and the two-cylinder 4–6–0 locomotive No. 2915 *"Saint Bartholomew,"* with a load of nine coaches, covered the distance in 72 minutes, so reaching Paddington three minutes early. The maximum speed attained was 77 m.p.h.

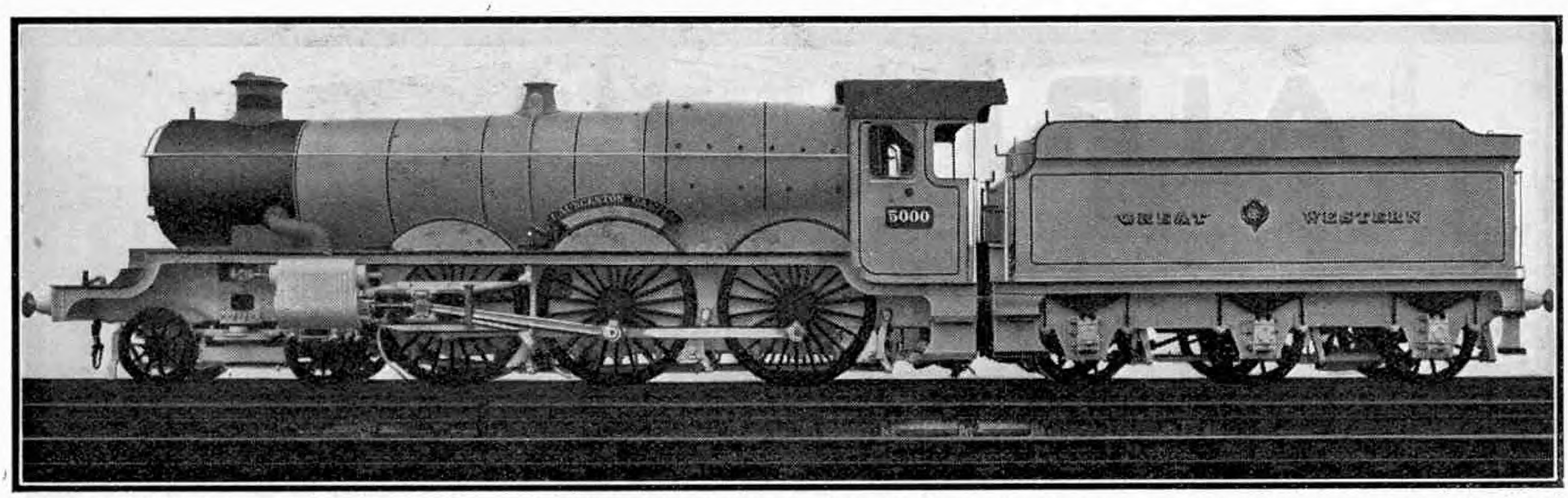
The above photograph shows the famous G.W.R. "Cheltenham Flyer"—the world's fastest train, as the board carried on the front of the engine proclaims.

The run is between Swindon and Paddington, the distance of 77¼ miles being covered in 67 minutes at an average speed of 69.2 m.p.h. This beats the 68.9 average of the Canadian Pacific Railway "Royal York" express mentioned in the August "M.M."

On 24th September, 1928, the train was withdrawn. It was again restored on 8th July, 1929, when only 70 minutes were allowed for the Swindon-Paddington journey, thus giving it pride of place as the fastest train in the world, with an average speed of 66.2 m.p.h. A brilliant run marked the inauguration of the sharpened schedule. The four-cylinder locomotive No. 5000 *"Launceston Castle"* headed the train and accomplished the trip in exactly 68 minutes—two minutes less than the booked time. The load was nine coaches and a maximum speed of 80.7 m.p.h. was sustained for two miles between Challow and Wantage Road. During the two years when that timing was in force, the run was done frequently in even less time and more than once was done in as little as 62 minutes.

In April of this year the Canadian Pacific Railway tabled two runs at start-to-stop speeds of 67.3 and 68.9 respectively, and in consequence the record of possessing the world's fastest train passed from Britain to Canada. Now the G.W.R. has answered that challenge by giving to the *"Cheltenham Flyer"* a lightning schedule which restores it to the foremost place again.

The inaugural run of the new timing on Monday, 14th September, created keen and widespread public interest. The engine chosen for this trial of strength and speed was that well-proved favourite No. 5000 *"Launceston Castle."* Among the splendid engines of the "Castle" class, none has a better reputation than *"Launceston Castle."* It achieved distinction when in October and November, 1926, it made a series of test runs on the L.M.S.R. It has many other fine runs to its credit, including the one on 8th July, 1929, to which reference has been made. All the drivers who have had charge of this locomotive speak well of it. One driver gave me his opinion and said that if *"Launceston Castle"* had a working pressure of 250 lbs. per square inch, it would do anything that a "King" could do. That, perhaps, is too high praise, but beyond doubt it is a superb engine. It had been through the works at Swindon about two months before and was in perfect running



G.W.R. four-cylinder 4-6-0 locomotive "Launceston Castle," which hauled the "Cheltenham Flyer" on its record-making journeys on the first three days on which the accelerated timing was in force. For this illustration, and the one on the opposite page, we are indebted to the courtesy of the G.W.R.

trim on 14th September. For this very special occasion a coloured placard bearing the inscription, "*Cheltenham Flyer*," "*World's Fastest Train*," was fastened on the front of the engine's smokebox. The train was composed of six coaches of the newest type and weighed, with passengers and luggage, close upon 200 tons.

Swindon was left on the stroke of time at 3.48 p.m. Acceleration was very rapid and within three miles of the start a speed of 70 m.p.h. had been attained. Shrivenham, 5.7 miles, was passed in 6 min. 28 sec., and by that time the speed exceeded 80 m.p.h. At Uffington it had reached 85 m.p.h. and the 10.8 miles from Swindon had been covered in 10 min. 10 sec. Didcot (24.2 miles) was passed in 19 min. 35 sec.; Reading (41.3 miles) in 32 min. 15 sec.; and Southall (68.2 miles) in 51 min. 30 sec. From Shrivenham until steam had to be shut off for the Paddington stop, the speed never fell below 80 m.p.h., and the 70 miles between mile posts 72 and 2 were reeled off in 50 min. 5 sec., giving an average of 83.8 m.p.h. The highest peaks of speed were 86.9 at Challow, 85.7 at Taplow and 89.1 at Ealing.

When the "*Flyer*" drew up at Paddington 7½ min. early, having made the run from Swindon in 59½ min., the enthusiasm of the passengers on the train and of the big crowd of spectators waiting in the station was warmly demonstrated. All the way from Swindon excited sightseers had waved the swiftly speeding train on its way, but when Paddington was reached in such amazing time the excitement was intense. Driver J. W. Street, Fireman F. W. Sherrer and Inspector H. J. Robinson, who were on the footplate, were loudly cheered. It was, indeed, a record-breaking run, with an average speed of practically 78 m.p.h.

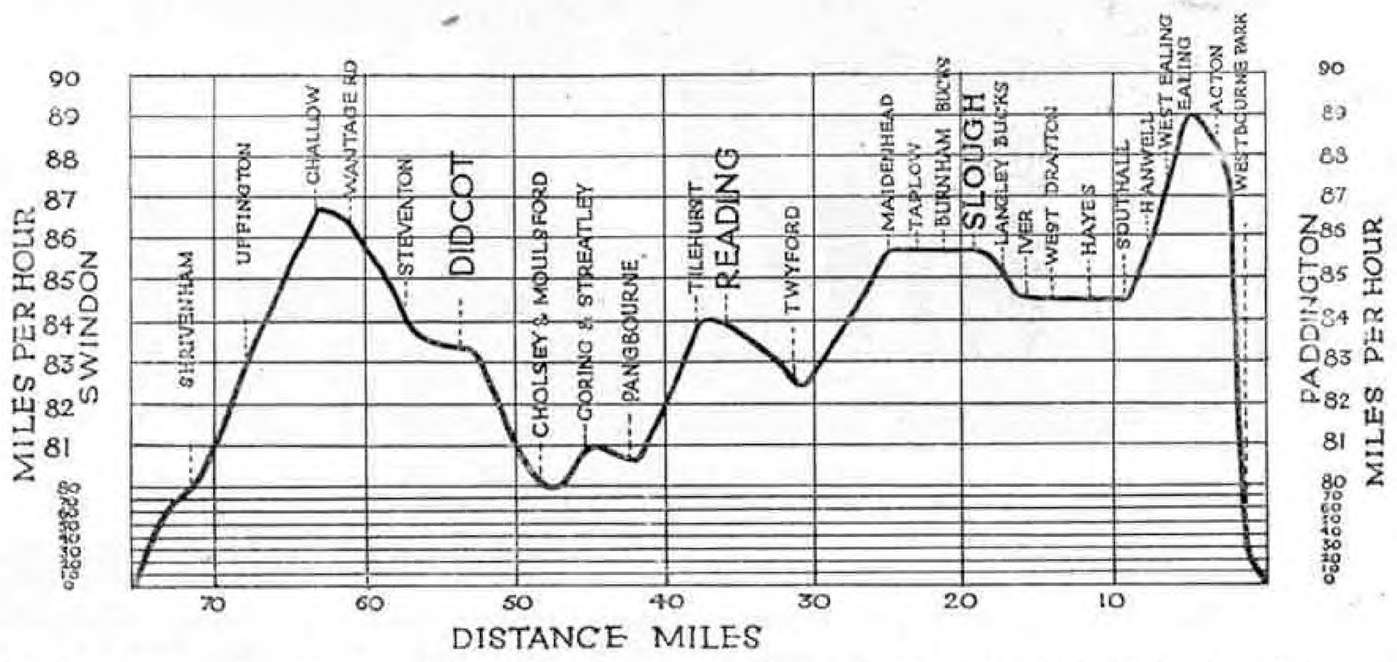
Yet, wonderful to tell, it was improved upon the following day when the same engine, with Driver C. Wasley in charge, and with an additional coach bringing up the load behind the tender to 230 tons, covered the 77¼ miles in 58 minutes, or at an average speed—start to stop—of 79.9 m.p.h.!

On Wednesday, 16th September, again "*Launceston Castle*" continued the running but with another different driver—H. Jones—in charge. The load was six coaches and Tuesday's overall time of 58 mins. was repeated. The approximate intermediate times on these two days were 19 min. to Didcot, and 32 min. to Reading.

After that the order went forth that henceforth drivers must adhere to schedule with the result that there has been no more record breaking. Mr. Cecil J. Allen informs me that he timed the train on Friday, 25th September, when it was again hauled by "*Launceston Castle.*" Very smart running in the earlier stages allowed an easy finish with a start to stop time of 66 min. 8 sec.

On Saturday, 3rd October, I saw the "*Flyer*" flash through Acton just before 12 minutes to five, which meant that even if Swindon had been left punctually, the 73 miles had been covered within the hour and over seven minutes remained for the 4.3 miles into Paddington. On one day only have I noted a late arrival since this latest acceleration. The "*Flyer*" was then five minutes behind time but the cause seemingly lay in the running of the "*Cornish Riviera Express*," which was fully ten minutes late that day and so checked the running of the following train. As against that, however, it is only fair to record a remarkable feat performed by the "*Riviera*" on Wednesday, 16th September. At Paddington that day I observed that according to the "Train Arrival Indicator," the "*Riviera*" was seven minutes late and I feared lest it would block the road of the "*Flyer.*" To my amazement, however, it ran in two minutes early! It had indeed, been seven minutes late at Reading but had travelled the 36 miles from there to Paddington in 30 minutes, and so left a clear track for the following "*Flyer.*"

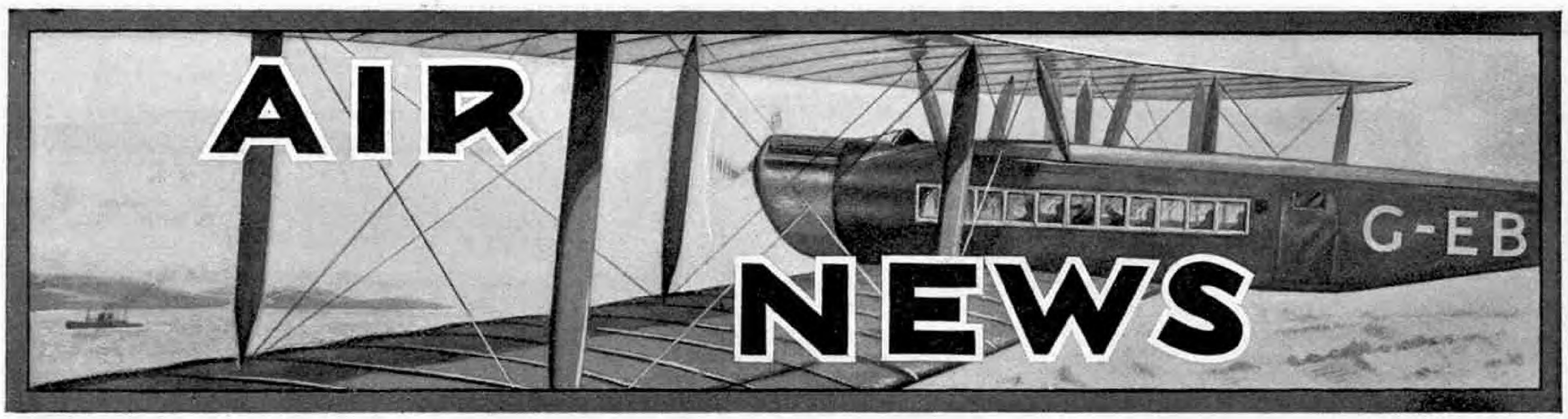
It is interesting to note that now at length the famous "Record of Records"—the run of the Ocean Mail Special on 9th May, 1904—has been surpassed. On that memorable occasion, the graceful 4–2–2 "single" locomotive, No. 3065 "*Duke of Connaught*," with a load of four eight-wheeled vans, ran from Swindon to Paddington in 60 min. 9 sec. It is true that no stop was made at Swindon but a severe slack at Cricklade demanded fully as much extra time as a dead start from Swindon would have done. Not until now has that marvellous effort been improved upon. The maximum speed of 102.3 m.p.h. which was attained on that same day in an earlier stage of the journey by the 4–4–0 locomotive "*City of Truro*" still stands unrivalled. But probably even that record will be broken ere long. It is certain that "*Launceston Castle*," having done 89.1 m.p.h. on the level, could, if pressed, attain to over 100 m.p.h. down Wellington bank. The truth is that in the brilliant runs recently made by the "*Cheltenham Flyer*," the engine has never been forced to its utmost power. Inspector Robinson told me at the close of the third day's trip that they could have brought two or three coaches more in the same time. He believes that a "King" could do the run in 55 minutes.



A diagram, reproduced by permission from the "Great Western Railway Magazine," showing the speed performance of the "Cheltenham Flyer" on its first run under the new schedule. No extraordinary maximum was reached, but the maintenance of speeds over 80 m.p.h. for 70 miles is particularly noteworthy.

It should be added that through all this speeding, the enginemen have exercised the most vigilant care. The final stage approaching Paddington has been covered very cautiously, and from Royal Oak inwards the running, as I have noted it, has been surprisingly slow.

The record-breaking runs chronicled above have greatly thrilled all railway enthusiasts and evoked unusual interest among the general public. They reveal remarkable possibilities of faster travel on all our railways and excite an expectancy of better things to come. It is intriguing to reflect, for instance, that when the schedule of the "*Cheltenham Flyer*" is cut by just one minute more, it will mean a start to stop run at over 70 m.p.h., and, again, when the best time so far achieved is reduced by only half-a-minute, it will give an average speed of fully 80 m.p.h. start to stop. Meanwhile the G.W.R. are to be heartily congratulated on their enterprise.



The Reid-Sigrist Turn Indicator

When flying in fog or clouds the most experienced pilot finds difficulty in keeping his course, and often is unable to tell whether he is flying upside down or in a normal manner. He is then compelled to rely on instruments, and a turn indicator has been specially designed by Reid & Sigrist for use in these conditions.

The new instrument is called the Reid-Sigrist Turn Indicator. It consists of a gyro wheel, mounted on gimbals, that has a number of small cup-shaped hollows on its circumference. Into these air is forced during the flight of the machine to which the instrument is fitted, and the effect of this is to turn the wheel at high speed. The axis of such a wheel tends to maintain a constant direction in space when it is spinning rapidly. When a machine in which it is fitted turns away from its course, therefore, the position of the axis of the wheel relative to it is changed and the movement is shown on the indicating dial mounted on the dashboard.

The Reid-Sigrist instrument also includes a sideslip indicator. This consists of a pendulum that is connected by means of gearing with a second needle on the instrument. When one wing of a machine in which the indicator is fitted is lower than the other, the pendulum swings towards the lower side and this in turn moves the needle, warning the pilot to correct the position of the machine.

The use of the new instrument will greatly simplify blind flying, for a pilot may judge his position with great accuracy by means of the two needles on its dial. Both should be kept at zero, and as the instrument is extremely sensitive, deviations may be corrected before they bring about serious results. It is of interest to note that the sideslip indicator has shown numerous pilots that they habitually fly their machines with one wing lower than the other.

First Solo Flight Round Australia

A new record for the flight round Australia has been set up by Mr. H. F. Broadbent, a member of the New South Wales Aero Club. The distance covered by Mr. Broadbent was 7,600 miles, and he completed the circuit in 7 days 8 hours 5 minutes, his total flying time being 83 hours 35 minutes. The previous record was held by Air Commodore Kingsford-Smith. Mr. Broadbent is the first man to make a solo flight round Australia.

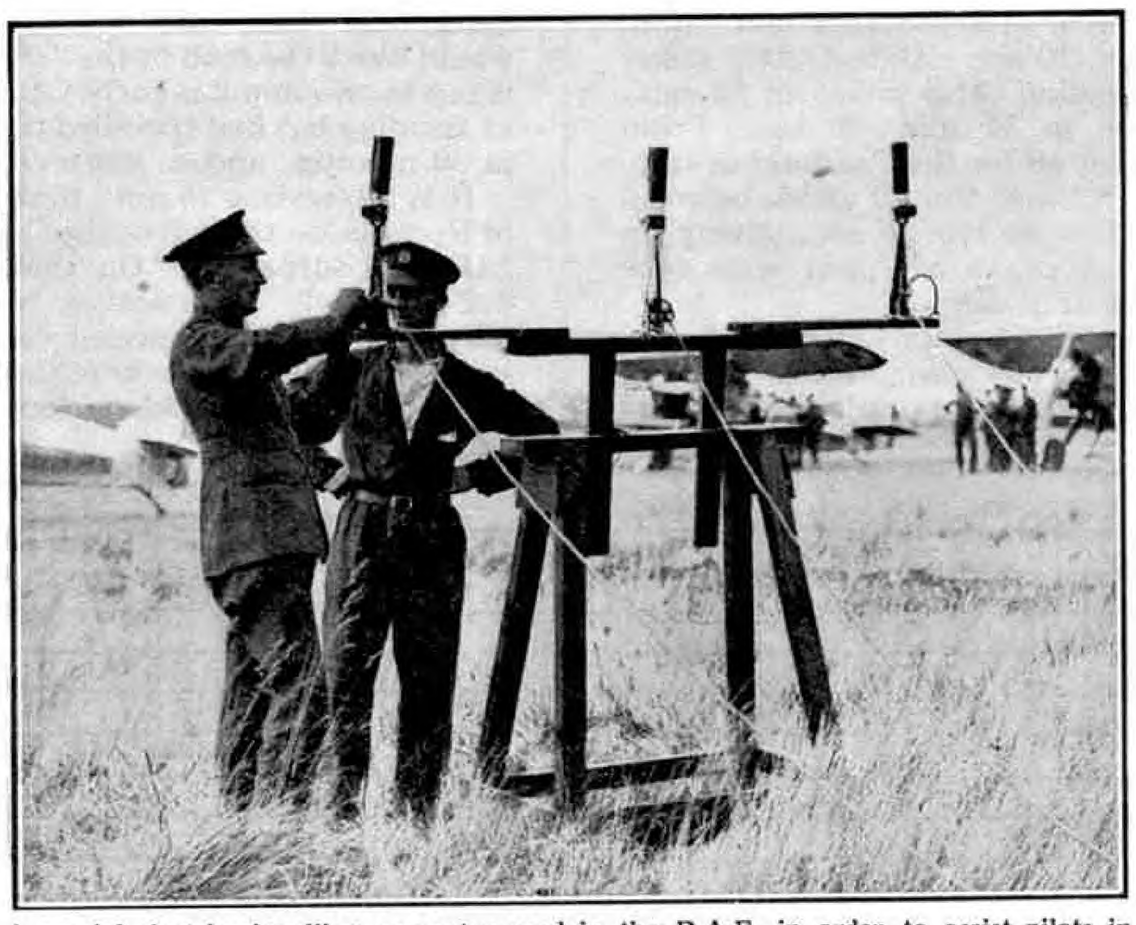
A Speedy American Monoplane

An interesting new high speed aeroplane, known as the Northrop "Alpha," has been produced in America. The machine is a low wing monoplane and is particularly suitable for mail work. It is of the all-metal type and is one of the fastest transport machines at present in service in the U.S.A.

The Northrop "Alpha" is fitted with a Pratt & Whitney 420 h.p. "Wasp" engine. It has a maximum speed of 170 m.p.h. with full load, and a cruising speed of 145 m.p.h. The stalling speed is 60 m.p.h. and the climb at sea level 1,400 ft. per minute. The machine has a fully loaded weight of 4,500 lb., and an empty weight of 2,260 lb. It may be obtained either as a landplane or a seaplane. The seaplane version has a gross weight of 4,700 lb. and an empty weight of 2,900 lb. Its maximum speed is 165 m.p.h. and its cruising speed 140 m.p.h. The rate of climb at sea level is 150 ft. per second less than that of the landplane. Both types of machine have a wing span of 41 ft. 10 in.

German Airship's Flights to America

The "*Graf Zeppelin*" recently flew from Friedrichshafen to Brazil and back. The double journey was completed in nine days, in spite of the fact that for two days the vessel remained in Brazil. This airship has now crossed the Atlantic on eight occasions and the number will probably be increased shortly, for it is announced that another aerial voyage to Brazil may be undertaken.



A special electric signalling apparatus used in the R.A.F. in order to assist pilots in returning to their aerodromes at night.

Compression Starter for Light Aeroplanes

A new pump for use with a compression starter for aero engines has been introduced by Vickers (Aviation) Ltd. It is claimed that this is less cumbersome than previous apparatus used for the purpose and that it may be carried in a light aeroplane.

In compression starting, a charge of compressed gas is forced into the cylinders, and this turns the engine round until the gas is ignited. The new equipment consists of a hand-operated pump, weighing only 8¾ lbs., and a standard air-bottle with a capacity of 390 cu. in. The air pressure in the bottle may be raised to 200 lbs. per sq. in. in ten minutes by means of the pump. This is well above the pressure usually necessary, for an engine of 500 h.p. normally requires one of 75 lb. per sq. in. to start it.

When it is desired to start an engine compressed air released from the bottle is passed through a special carburetter by means of which it is charged with a proportion of petrol vapour. This explosive mixture is then passed directly into the cylinders.

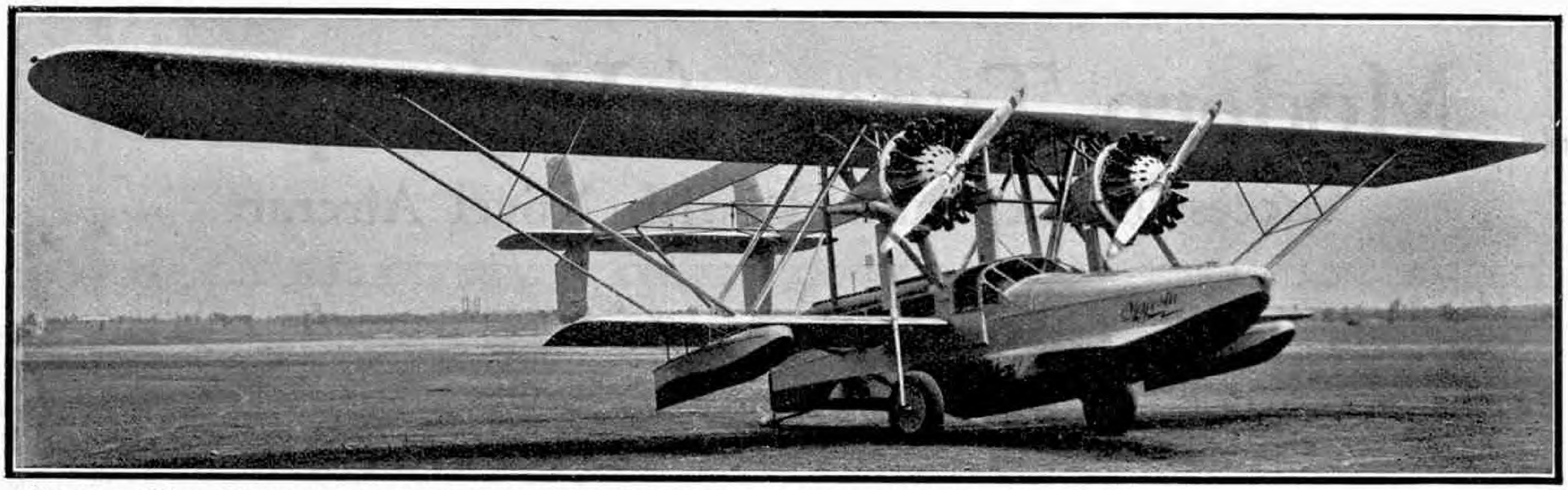
The Capetown Airport

The airport at Capetown that is to be the terminal of the England-Capetown air route operated by Imperial Airways is now rapidly approaching completion. The aerodrome is situated about six miles east of Capetown and occupies an area of about one square mile. It is being organised on similar lines to that at Croydon. A large hangar of all-metal construction already has been built, and the two main runways, which lead into the two prevailing winds, also have been constructed. The remainder of the aerodrome surface is covered with grasses that are specially suitable for the purpose of binding together the sandy soil.

The total cost of the airport is estimated at £50,000. It is expected that the whole of the work will be completed by January, 1932, and that Imperial Airways will then be able to extend their services to the Cape.

* * * *

An interesting example of the value of the aeroplane when conducting an extended search in difficult country comes from Switzerland. Five climbers recently were lost on the Aiguilles Rouges d'Arolla, in the Alps, and were marooned for four days on a ledge of rock before guides could reach them. They were located by an airman, who succeeded in flying low over the party and dropping supplies of food and blankets.



A Sikorsky amphibian. The two outriggers that support the tail unit of this interesting machine are plainly discernible. The total length of the flying boat is 40 ft. 3 in., while it measures 13 ft. 10 in. in height. Machines of this type are extensively used on American air lines.

The Sikorsky S-38 Amphibian

One of the most interesting and unusual amphibian flying boats at present in production in the United States is the Sikorsky S-38 machine constructed by the Sikorsky Aviation Corporation. This aeroplane is unusual in that the rudders and elevators are not fixed on the hull of the machine in the usual manner but are carried on two outriggers that run aft from the top plane. Twin fins and rudders are provided. In spite of its unorthodox features the machine is quite a success and is used extensively by the U.S. Government, the Western Air Express, Inc., Pan-American Airways, Inc., and other air line companies.

The Sikorsky machine is a twin-engined commercial nine-seater and is of the sesquiplane type, the span of the top plane being 71 ft. 8 in. and that of the lower one 36 ft. The nine passengers are carried in the hull, in which there also is accommodation for mails and a cockpit for the pilot and the flight mechanic. The wheels for alighting on land are retractable. They are in separate units, are hinged to the engine mountings,and are operated hydraulically. When not in use they are carried flush under the bottom planes.

The amphibian is fitted with two 420 h.p. Pratt & Whitney "Wasp" radial air-cooled engines giving a maximum speed of 125 m.p.h. The cruising s eed is 110 m.p.h. and the stalling speed 55 m.p.h. The aeroplane takes off from land in 12 seconds, while 18 seconds are required for a take off from water. The initial rate of climb is 750 ft. per minute.

The empty weight of the machine is 6,500 lb. With a pay load of 1,700 lb. and sufficient fuel and oil to enable the machine to cruise for 600 miles, its all-up weight is 10,480 lb.

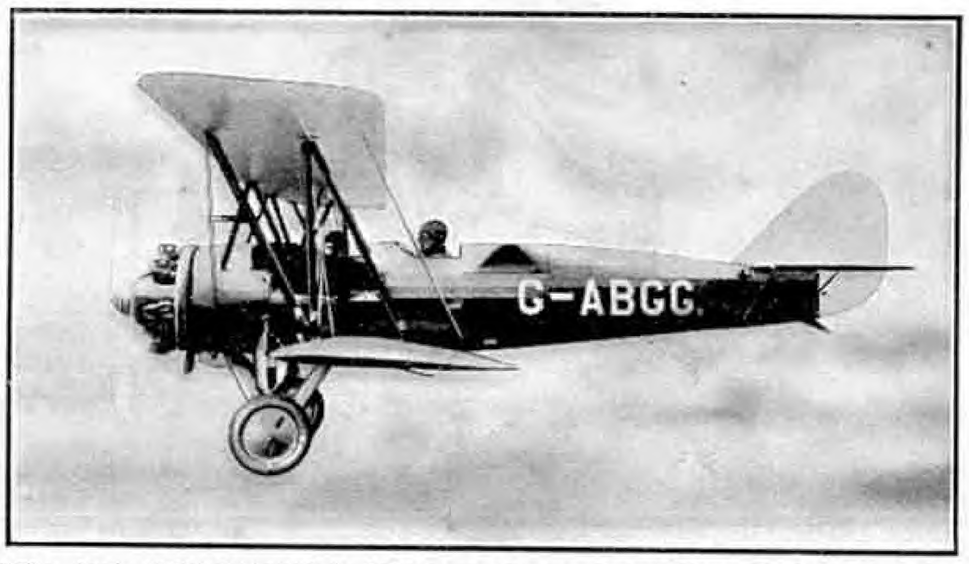
Air Service Speed of 175 m.p.h.

An air service that has been inaugurated between Chicago and Washington is remarkable for the high speed that is being maintained. The route is by way of Canton and Pittsburgh, and is 600 miles in length. It is covered in 3 hours 25 minutes, the average speed being a little more than 175 m.p.h. The service is being operated by Lockheed "Orion" seven-seater aeroplanes. These machines have retractable undercarriages in order to decrease air resistance, and their maximum speed is about 215 m.p.h.

Remarkable Flights in the Comper "Swift"

Two remarkable flights have been made recently in Comper "Swift" single-seater machines. One of these flights was made by Lieut. C. Byas, R.N., who flew from England to Johannesburg. Lieut. Byas was not endeavouring to set up a record, but he nearly succeeded in doing so, for he covered the distance of 7,320 miles between Heston and Johannesburg in 73 hours. This gives an average speed of over 100 m.p.h., which is remarkably high in view of the fact that the Pobjoy R engine employed develops only 85 h.p. The "Swift" is very economical to run, the petrol consumption for the journey to Johannesburg working out at the low figure of 4½ gallons per hour.

The second flight was made by Flt. Lt. N. Comper, the designer of the "Swift," who flew to Italy and back in 26 hours. The total distance flown was 2,000 miles, the cruising speed for this trip also being more than 100 m.p.h. in spite of strong head winds that were encountered.



The Avro 626 advanced training machine, a description of which is published on this page. Our photograph is reproduced by permission of A. V. Roe & Co. Ltd.

Transatlantic Mail Record

On 9th September, European mail from the North German Lloyd steamship, "*Europa*," was delivered in New York only 3 days 21 hours after leaving Cherbourg. This feat was made possible by the use of a mail seaplane, which was catapulted from the deck of the "*Europa*" when the vessel was still 1,275 miles from New York. During its flight the seaplane made two stops to be refuelled, the first at Sydney, Cape Breton Island, and the second at Bridgeport, Connecticut, but the journey was completed in 22 hours, and the machine reached New York 30 hours before the arrival of the "*Europa*."

New Avro Training Machines

It is claimed that more pilots have been trained on aircraft made by A. V. Roe & Co. Ltd. than on any other type of training machine. This lends interest to the latest productions of the firm—the Avro "Trainer" 621 and the Avro 626. The first of these machines is intended for elementary instruction, and the second is equipped for training of an advanced character.

In view of their purpose, both machines have been designed to possess high shoc absorbing qualities, to be robust an to require very little attention, and i the event of damage they may easily be repaired. They are fitted with Armstrong Siddeley "Lynx" engines. Their fuselages are of welded tubular construction. In each machine the main plane structure consists of two supports built up of steel sheet with light metal ribs and tubular steel drag struts, braced with swaged steel wires. The machines are covered with doped linen.

Undercarriages of the wide track type are fitted to the two aeroplanes in order to give stability when manœuvring on the ground and they have no transverse axle, thus reducing the risk of accident when landing on rough ground. Both types may be obtained as landplanes or seaplanes.

Each of the machines has a wing span of 34 ft. and is 9 ft. 7 in. in height. The length is 26 ft. 5 in. The 621 machine has a maximum speed at sea level of 116 m.p.h. while the maximum speed of the advanced type is only 114 m.p.h. The cruising speeds are 100 m.p.h. and 95 m.p.h. respectively. The "Trainer" lands at 46 m.p.h. and the 626 at 48 m.p.h.

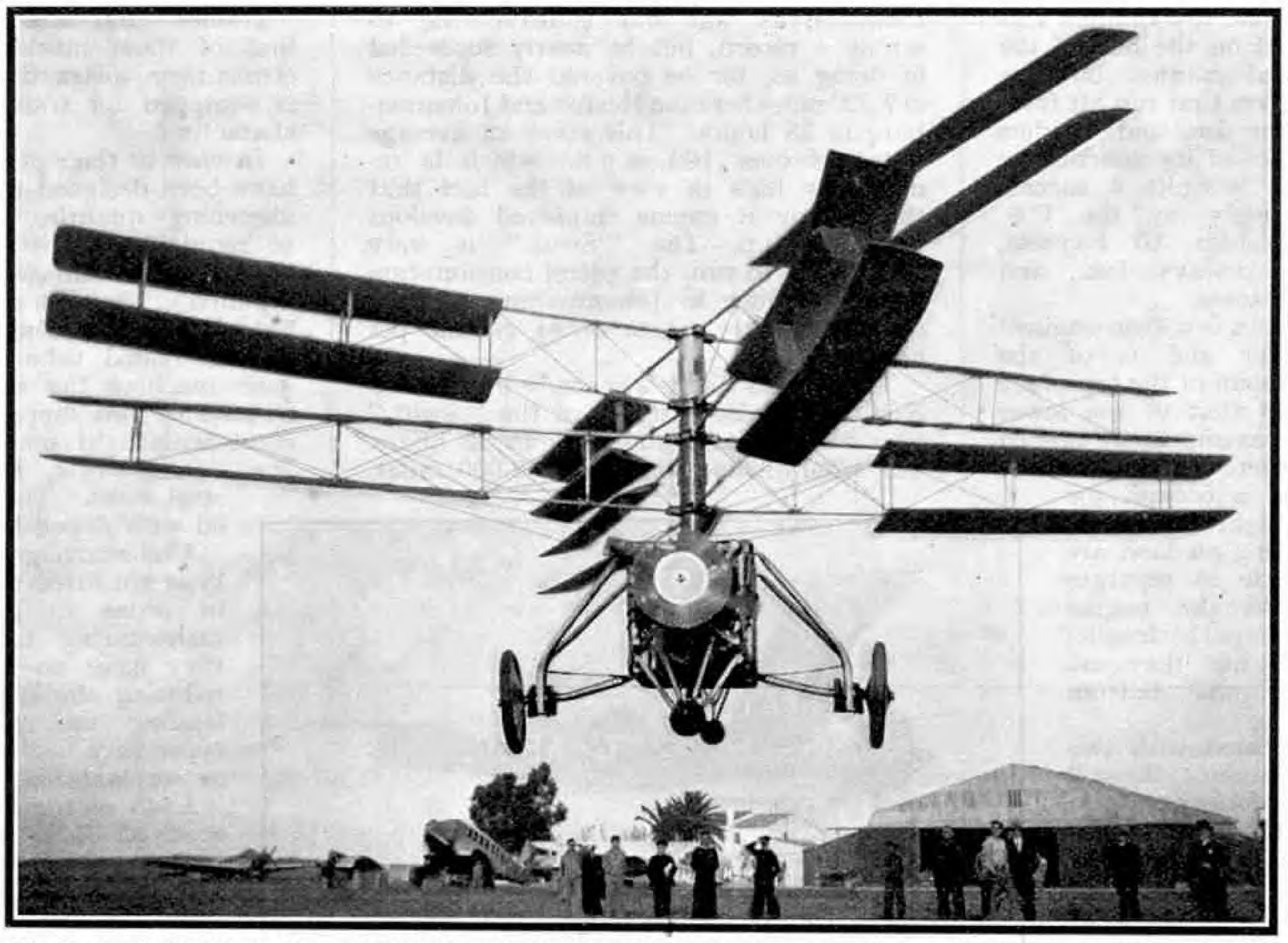
A particularly valuable feature of the Avro 626 is that the whole of the advanced training of a military pilot may be carried out on the one machine. On this he may learn how to use machine guns in aerial fighting, to drop bombs, and to operate an aerial camera and wireless instruments in addition to the use of instruments in navigation or above clouds. The machine also may be fitted with floats in order that instruction in flying from water may be given. The use of the Avro 626 thus helps to keep the equipment of a training school at a minimum, while the number of spares that must be kept in stock also may be considerably less than that necessary when several types of aeroplanes are used.

Modern Types of Helicopters

Successful Experiments with Novel Aircraft

EVER since the days when man first began to dream of flying, inventors have tried to design machines that would be capable of ascending and descending vertically, and of hovering motionless in the air. Their first idea, naturally, was to imitate the flight of birds, and they built models or designed machines that were to be sustained by the beating of wings. No success was ever attained with ornithopters, as machines of this kind would now be called, and in later efforts horizontal airscrews were substituted for flapping wings. A machine to be sustained in the air in this manner is now called a " helicopter." Its name is derived from two Greek words, *helix*, a screw, and *pteron*, a wing, and thus indicates that it derives its lift from the action of the airscrew fitted to it.

The earliest known reference to this mode of flying is to be found in Leonardo da Vinci's *"Treatise on the Flight of Birds,"* written more than 400 years ago. Later a helicopter was planned by Sir George Cayley, a British pioneer of aeronautical science, but the want of a light powerful engine prevented him from carrying out experiments of real practical value. Inventors then concentrated on trials with gliders, and when the petrol engine eventually became available the development of the ordinary aeroplane from their comparatively crude productions turned their attention away from the helicopter. To a certain extent interest in it has revived, however, and to-day experiments are being made with machines of this type produced by inventors in various parts of the world.



The Pescara helicopter making a trial flight. The two great lifting airscrews rotate in opposite directions. Our photograph is reproduced by courtesy of the Marquis de Pescara.

The experimental helicopters so far constructed resemble each other in general design. A light fuselage carries the engine, a cockpit for the pilot, and the undercarriage, and above it are the vanes, or blades, of the lifting screw. This screw acts like the propeller of a normal aeroplane, but as it rotates horizontally instead of vertically, the machine to which it is attached is literally screwed into the air. The blades are much larger than those of an ordinary propeller, for great power must be exerted in order to give the required vertical lift.

A machine constructed on these principles should be capable of rising and descending vertically while under complete control. It should also be able to hover practically motionless in the air, in addition to travelling in a horizontal direction. The introduction of a really satisfactory helicopter therefore would solve the problem of taking off from a confined space or alighting in it, and as no question of landing speed would arise, flying undoubtedly would become very much safer. On the other hand, it must be remembered that the lifting screws of a helicopter are called upon to support the entire weight of the machine, and merely to remain motionless in the air requires a great power output. This need for power has prevented the development of the helicopter, and is perhaps the greatest of the difficulties that must be overcome by inventors interested in machines of this type. Another difficulty that may be almost as formidable is that of ensuring the stability of the machine when in the air.

Two modern experimental helicopters are worthy of special notice because they have actually been flown. One of these is the production of Signor d'Ascanio, an Italian inventor, and the second was designed by the Marquis de Pescara, a Spanish engineer. A third helicopter that also is of great interest is the invention of Mr. M. Bleecker, an American, and is being developed by the Curtiss Aeroplane and Motor Corporation. Little is known about this machine, but it may be regarded as a promising effort to solve the chief problems that confront the inventor in this field.

Of these three machines, that designed by d'Ascanio appears to be the most advanced, for in November of last year several records were established in it at the Ciampino Nord Aerodrome, Italy. These were for altitude, endurance and distance flown in a straight line. The greatest height attained was 59 ft. The endurance record was secured with a flight of 8 min. 45 sec., and that for distance flown in a straight line was made by flying the machine from one end of the aerodrome to the other.

The d'Ascanio helicopter is a single-seater machine with a weight of about 1,760 lb. and is fitted with a Fiat A.50 S. engine developing 95 h.p. The fuselage is of the usual helicopter type, and consists of a bare metal framework with the cockpit set in the middle. Mounted above the fuselage is the central shaft on which are journalled two large horizontal airscrews. These rotate in opposite directions to each other, for otherwise the fuselage would develop gyroscopic motion that would interfere with efforts to control the machine. The airscrews, which are of the two-bladed type, turn at a speed of about 75 r.p.m.

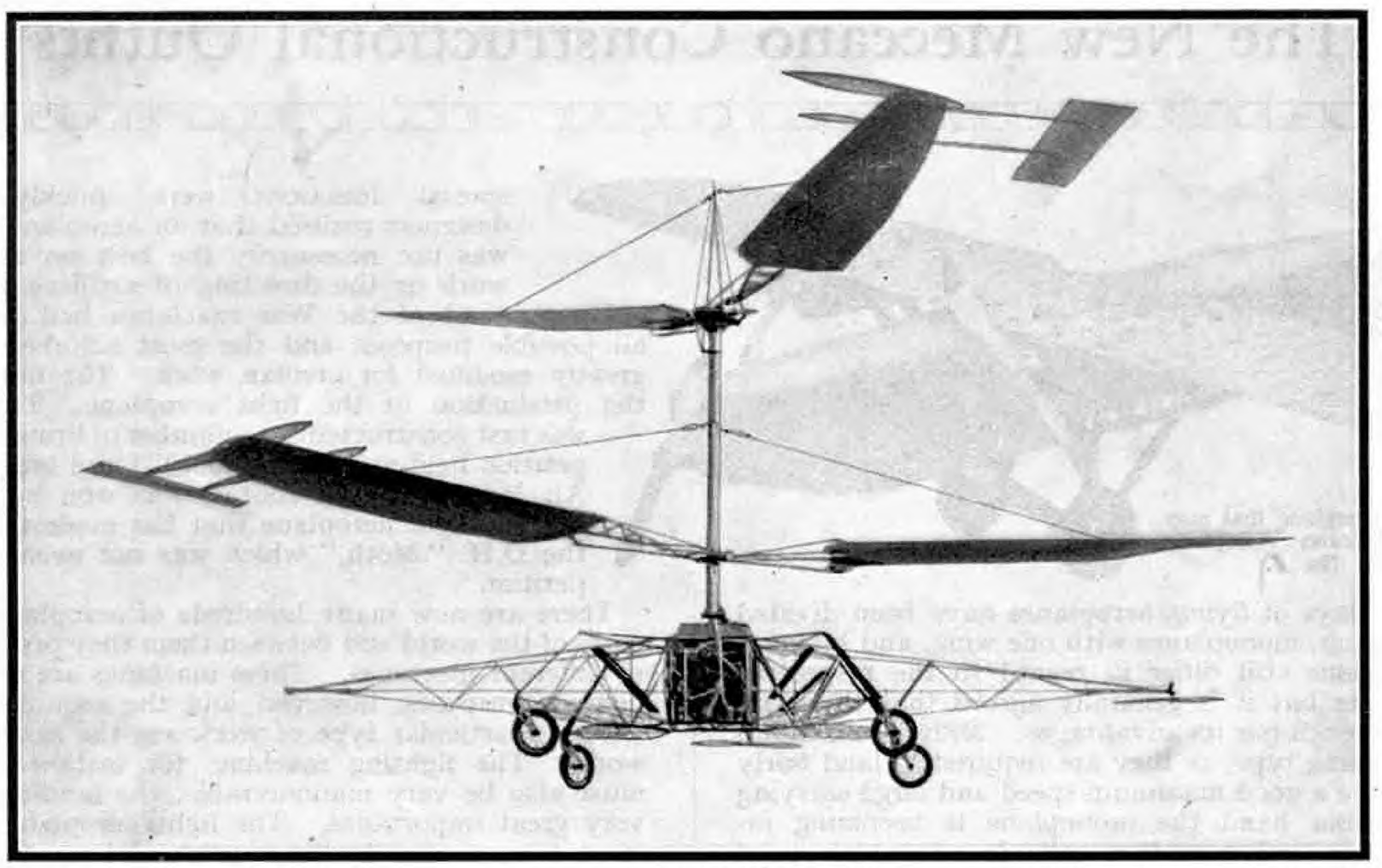
The machine is piloted by means of three controls identical with those of an ordinary aeroplane. These consist of a control stick, a rudder bar and an elevator, but in the d'Ascanio helicopter they are employed to move small control airscrews, instead of ailerons, rudder and elevator as in an ordinary aeroplane.

The control airscrews are three in number, one being placed under the tail of the fuselage and the others on the left and right of the cockpit respectively. The airscrew on the right of the pilot's seat is vertical, like that of an aeroplane of the ordinary type; but the remaining two are horizontal.

When the control stick is pulled backward, the pitch of the horizontal airscrew under the tail of the machine is altered, this

control giving longitudinal stability to the machine. The propeller on the left of the pilot, which also rotates horizontally, is operated by a sideward movement of the stick, and is employed to give lateral control and stability. The two horizontal airscrews also are used when a horizontal flight is to be made. For this purpose the machine is inclined in the direction to be taken, and the necessary position is achieved with their aid. The vertical airscrew is moved by means of the rudder bar, and is used for steering purposes.

The blades of the two huge propellers that raise the d'Ascanio helicopter in the air are of aerofoil section. In this respect they resemble the wings of ordinary aeroplanes, and they depend for their lifting power on similar principles. Their effect may be increased by changing the angle they make with the horizontal, a plan that is followed in the d'Ascanio machine. When the pilot of this helicopter wishes to rise, he pulls a lever placed near the throttle of the engine. The effect of this is to tilt elevators that are mounted on the revolving blades, and the movement of these brings about the necessary change in the angles of incidence of the blades to give the machine the required extra lift.



An experimental flight by the D'Ascanio helicopter, which holds three world's records for this type of machine. For this photograph we are indebted to Lt. Col. P. F. Bitossi, Air Attaché to the Italian Embassy.

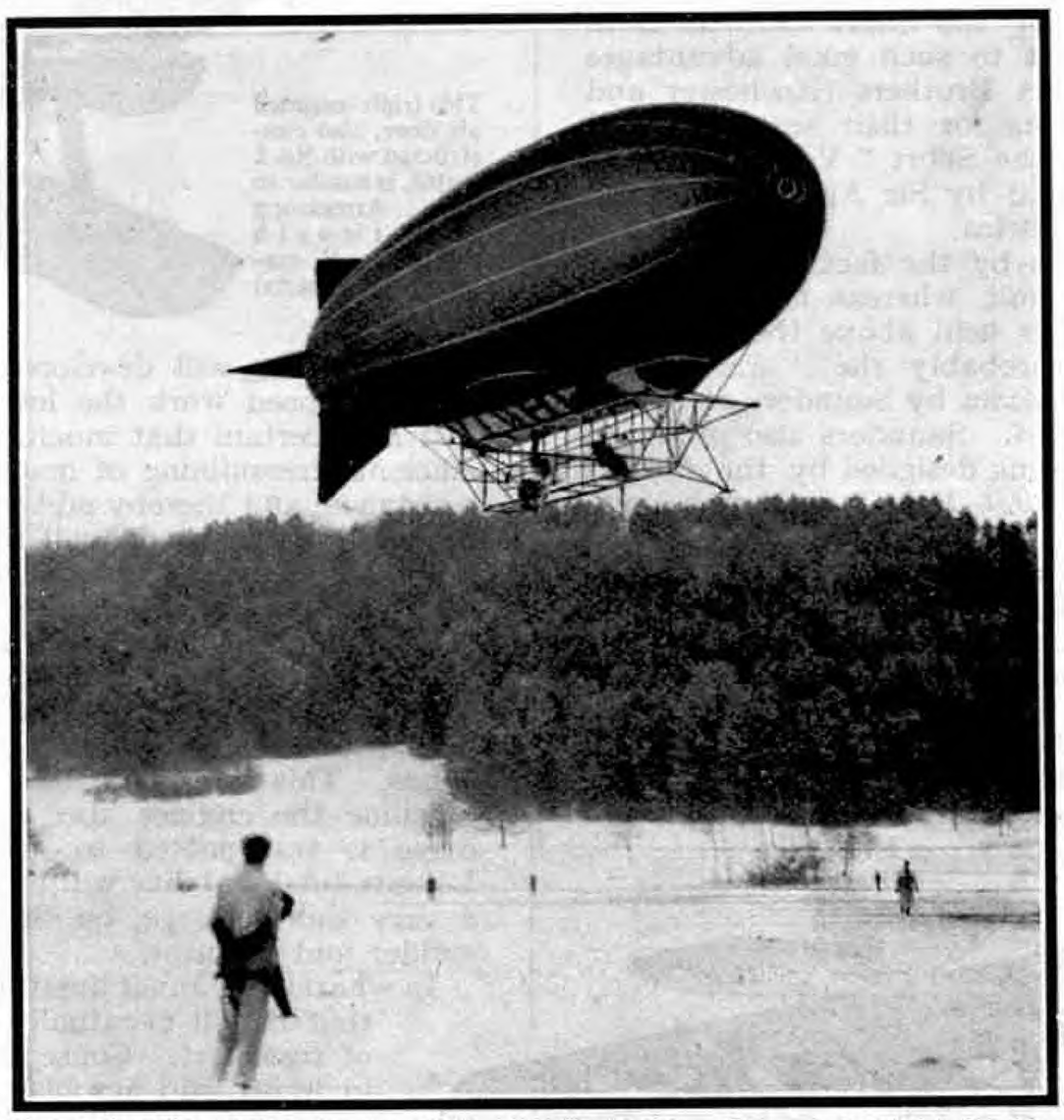
It is interesting to note that if the engine of the d'Ascanio helicopter failed during a flight, the lifting blades would continue to rotate, as they are connected with the engine through a free-wheel device. A safe landing therefore could be made, for the machine would be converted into a kind of parachute, and would sink comparatively slowly through the air. It will be seen that in these circumstances the d'Ascanio helicopter would practically become an "Autogiro" and would make a landing similar to that of one of these well-known aeroplanes.

The d'Ascanio helicopter in which the records already mentioned were made was built for the purpose of showing that its design is based on sound principles. Later a new model is to be constructed in order to demonstrate the practical uses of the invention.

The Curtiss-Bleecker machine that is being developed in America is a helicopter of a very interesting type. It is still in the experimental stage, but apart from differences in the fuselage, it is similar in appearance to the d'Ascanio machine. It has a lifting airscrew composed of four horizontal blades mounted above the fuselage. The blades are of aerofoil section and are driven by means of small airscrews, one being fitted to each blade. A complicated system of shafts and universal joints transmits power to these airscrews from a Pratt and Whitney "Wasp" engine placed in a nacelle situated midway between the two cockpits of the machine. A curious feature is that the nacelle in which the engine is mounted is free to rotate, the purpose of this being to prevent the machine from revolving in the opposite direction to the lifting airscrew.

When the blades are moving with the wind their speed relative to the airstream is greater than when they are moving against it. Unless special precautions were taken, the result of this would be to give the machine a greater lift on one side than on the other, so causing it to bank over when in flight. A novel scheme has been evolved in order to prevent this. Behind the blades of the lifting airscrew are small vanes, 12½ sq. ft. in area, of aerofoil section. These are mounted on struts attached to the blades and are called "stabovaters." As each of these turns into the wind it tends to rise and to lift with it the trailing edge of the blade on which it is mounted. The angle presented to the airstream by the blade therefore is decreased and it loses a proportion of its lift. This is sufficient to compensate for the increased lift due to its greater air speed, and thus the entire machine maintains a level position. As each blade turns to travel with the wind, the stabovater mounted on it falls back to its normal position.

Another interesting feature of the machine is that the rudder is hinged longitudinally instead of vertically. The reason for this is that the slipstream from the rotating blades is forced downward, and would have no effect on a rudder hinged in the ordinary manner.



The Oehmichen helicostat in flight at Valentigney. We are indebted to the courtesy of M. Etienne Oehmichen for this photograph.

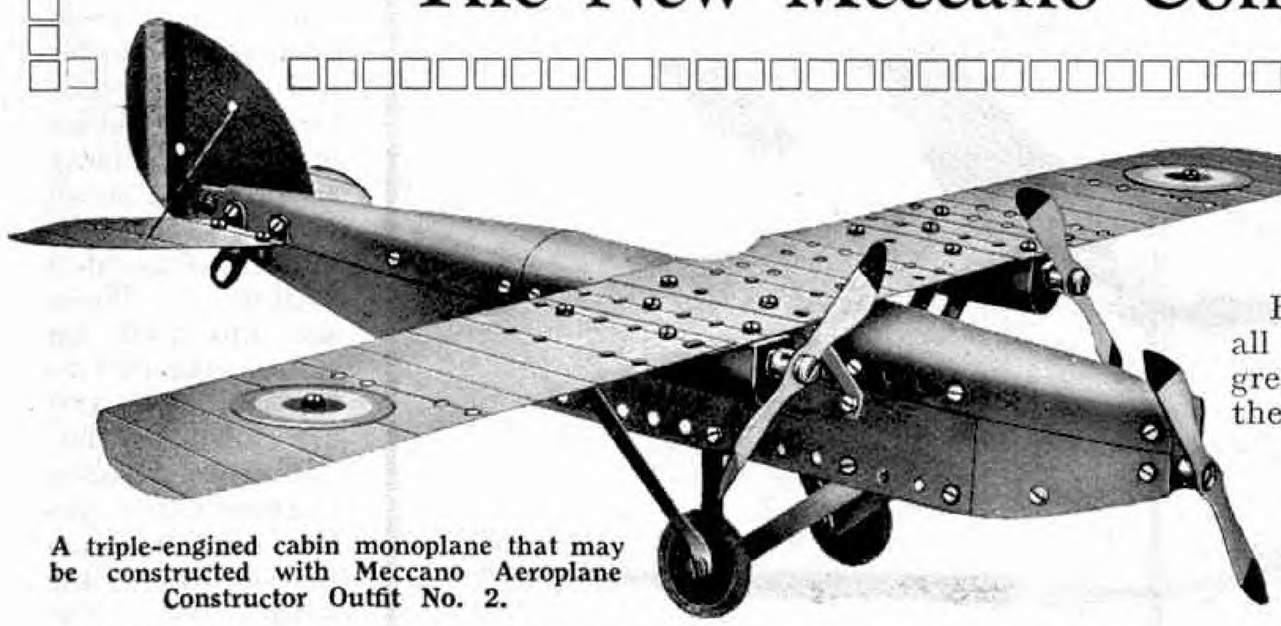
The third of the helicopters to which we have referred—that designed by the Marquis de Pescara—does not differ in essentials from the machines of this class that we have already described. It has two lifting propellers, each of which consists of eight blades. These are mounted on the same vertical shaft and, like those of the d'Ascanio helicopter, they rotate in opposite directions in order to avoid gyroscopic effects. A special feature of the machine is that an ordinary driving propeller is fitted. The power unit employed is a 40 h.p. Salmson engine, and this may be used to drive either the ordinary airscrew or the lifting propellers, suitable clutches being provided.

The machine is controlled by warping the blades and by varying the angles they present to the airstream. The ordinary control stick is employed to effect the necessary changes. The blades of the two lifting propellers may be set at different angles by means of a separate control actuated by a paddle. When the machine is moving horizontally or descending vertically with the engine out of action, the lifting propellers are disengaged and they revolve idly in a similar manner to the vanes of an "Autogiro," the machine meanwhile remaining under full control of the pilot.

It is interesting to learn that the first (*Continued on page 892*)

Building Your Own Aeroplanes!

The New Meccano Constructional Outfits



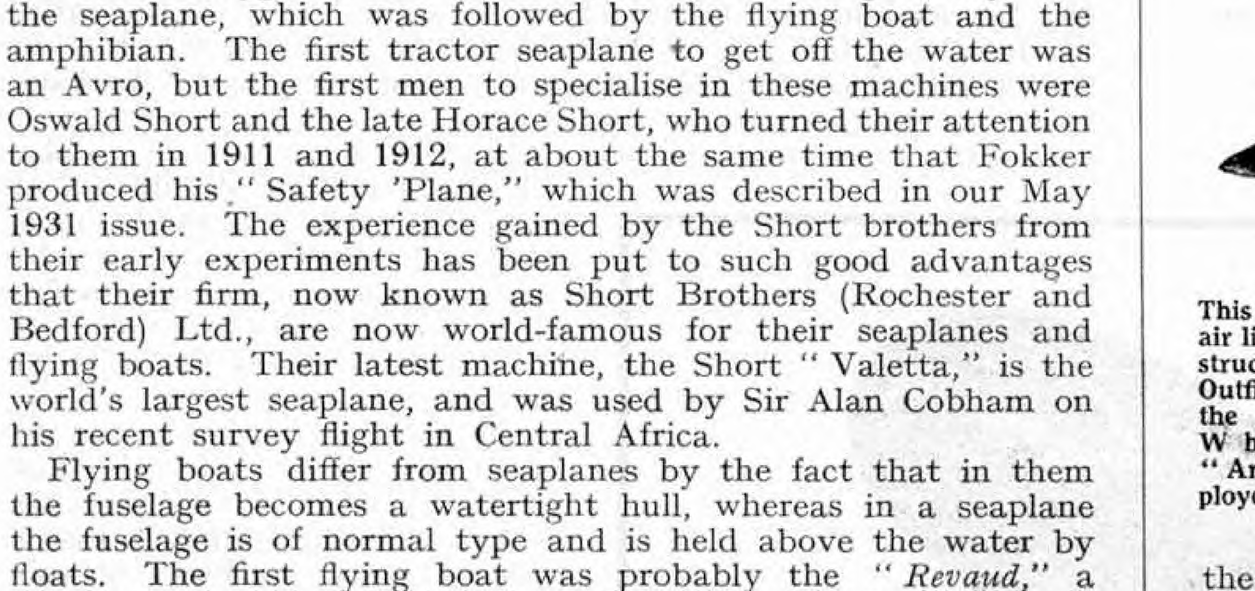
A triple-engined cabin monoplane that may be constructed with Meccano Aeroplane Constructor Outfit No. 2.

SINCE the earliest days of flying, aeroplanes have been divided into two main types, monoplanes with one wing, and biplanes with two. Opinions still differ in regard to the respective merit of the two types but it is generally agreed that there are certain uses for which each has its advantages. Military machines are usually of the biplane type, as they are required to land fairly slowly, and yet to have a good maximum speed and large carrying capacity. On the other hand the monoplane is becoming increasingly popular for civil machines intended for high-speed work, particularly in Germany, where the low wing machine is extensively used.

The next type of machine to be constructed probably was the seaplane, which was followed by the flying boat and the amphibian. The first tractor seaplane to get off the water was an Avro, but the first men to specialise in these machines were Oswald Short and the late Horace Short, who turned their attention to them in 1911 and 1912, at about the same time that Fokker produced his "Safety 'Plane," which was described in our May 1931 issue. The experience gained by the Short brothers from their early experiments has been put to such good advantages that their firm, now known as Short Brothers (Rochester and Bedford) Ltd., are now world-famous for their seaplanes and flying boats. Their latest machine, the Short "Valetta," is the world's largest seaplane, and was used by Sir Alan Cobham on his recent survey flight in Central Africa.

Flying boats differ from seaplanes by the fact that in them the fuselage becomes a watertight hull, whereas in a seaplane the fuselage is of normal type and is held above the water by floats. The first flying boat was probably the "*Revaud*," a machine constructed for Sir Hiram Maxim by Saunders of Cowes, now the well-known Saunders-Roe Ltd. Saunders also produced an amphibian in 1912, the machine being designed by the famous Sopwith, who also designed the "*Bat Boat*" that was completed in 1913.

At the beginning of the Great War aeroplanes were not designed for any special work, but were really general purpose machines. They were first used for reconnaissance work, and many writers at the time predicted that they would never be of any value for any other purpose. The machines that went up were unarmed, except for the revolvers carried by the pilots and the rifles carried by the observers in the two-seater machines. This state of affairs did not last long, and machines designed to carry out various special functions were quickly evolved. Aircraft designers realised that an aeroplane suitable for fighting was not necessarily the best for reconnaissance patrol work or the directing of artillery fire.



Another No. 2 Outfit model. This is a triple-engined flying boat.

By the end of the War machines had been constructed for all possible purposes and the most suitable of them were then greatly modified for civilian work. The next development was the production of the light aeroplane. This type of machine was first constructed by a number of firms to take part in a competition held at Lympne in 1923 and organised by the British Air Ministry. The contest was won by the Avro "Baby," but the light aeroplane that has made the greatest success is the D.H. "Moth," which was not even entered in the competition.

There are now many hundreds of aeroplane constructors in all parts of the world and between them they produce many thousands of different machines. These machines are divided into types for distinct purposes, however, and the requirements of a machine for any particular type of work are the same in any part of the world. The fighting machine, for instance, must be fast and must also be very manœuvrable, the landing speed not being of very great importance. The light aeroplane, on the other hand, must have a slow landing speed, and must be easy and safe to control, high speed being a secondary consideration.

It is impossible to prophesy with any degree of certainty how



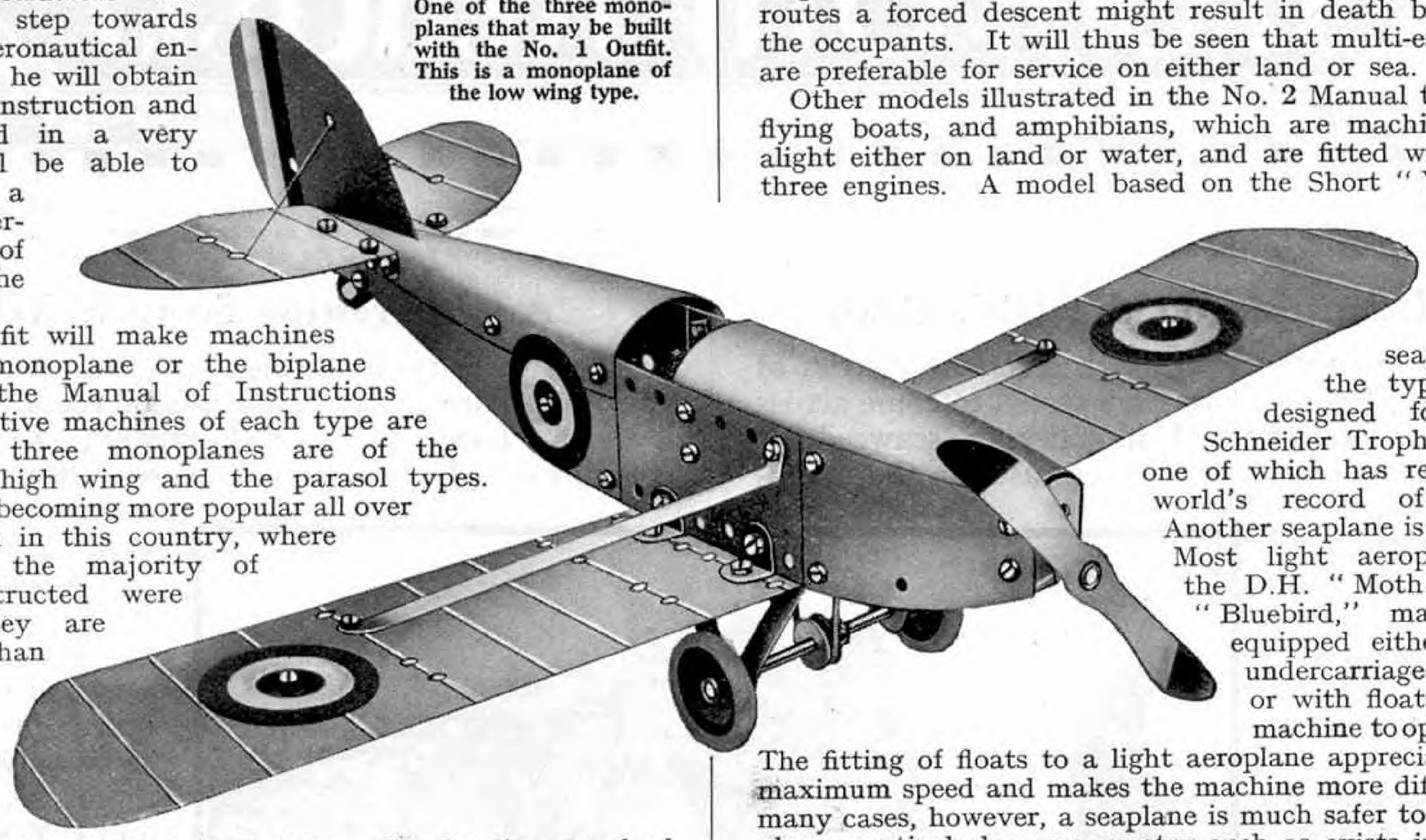
This triple-engined air liner, also constructed with No. 2 Outfit, is similar to the Armstrong Whitworth "Argosies" employed by Imperial Airways.

the aeroplane will develop in the future. It is probable that for high-speed work the low wing monoplane will be favoured, and it is certain that much greater attention will be paid to the efficient streamlining of machines. In order to decrease drag or resistance, and thereby add to the maximum speed, all parts that project from the body will be provided with faired cowlings, and it is probable that the undercarriages will be made retractable, as has already been done on some machines. Thus immediately an aeroplane has taken off from an aerodrome the undercarriage will be wound up and hidden in a cowling below the fuselage.

Aeroplanes as we now know them may eventually be displaced by machines in which the passengers will be carried inside the wings. This has been done in the Junkers G.38, and in this machine the engines also are carried inside the wings and the drive is transmitted to the airscrews through cardan shafts. Longitudinal stability will be provided by an outrigger, or possibly a very thin fuselage, on the end of which will be mounted the rudder and elevator.

In whatever manner aviation may develop there can be no doubt that it will eventually become the most important branch of transport. Consequently all boys who take an interest in flying and aeroplanes should be able to distinguish the various types of machines, and understand the purposes for which they have been designed, in the same way that most boys know the names and types of locomotives and motor cars. In order to assist boys in acquiring this knowledge, and to give them many hours of fun and excitement the Meccano Aeroplane Constructor Outfits have been produced. The No. 1 Outfit contains a complete set of aeroplane parts, and in order to show how these should be used, six types of machines are fully described in the Manual of Instructions that is presented with

the Outfit. The No. 2 Outfit contains instructions for making another 16 models of a more advanced type. All the parts are designed on correct engineering principles and are similar to those used by aeronautical engineers in the construction of real aeroplanes. Thus a boy who purchases one of the Meccano Aeroplane Constructors has taken the first step towards becoming an aeronautical engineer. From it he will obtain many hours of instruction and amusement and in a very short time will be able to distinguish at a glance the different types of machines that he sees.



One of the three monoplanes that may be built with the No. 1 Outfit. This is a monoplane of the low wing type.

The first Outfit will make machines of either the monoplane or the biplane type, and in the Manual of Instructions three representative machines of each type are included. The three monoplanes are of the low wing, the high wing and the parasol types. Monoplanes are becoming more popular all over the world, even in this country, where until recently the majority of machines constructed were biplanes. They are usually faster than biplanes of similar weight with engines of equal power, and a much better view may be obtained from them. The landing speed of monoplanes is generally higher, however, and biplanes are more stable in the air, while they possess better weight-lifting capabilities.

The three types of light biplanes selected are the standard light machine, the single-seater fighter and the training biplane. All these types are specialised in in Great Britain, which has produced the world's most famous machines in each of the categories. The de Havilland "Moth," for instance, is known all over the world, and it is an undisputed fact that Great Britain controls practically the whole of the world's light aeroplane trade. Famous British machines of the single-seater fighter class are the Bristol "Bulldog" and the Hawker "Fury." The latter is not an ordinary single-seater fighting machine, however, but is known as an interceptor fighter, designed to possess an exceedingly fast climb and maximum speed, endurance and military load being sacrificed to attain this end. The Bristol "Bulldog" is probably the world's most famous military machine, and the Air Forces of eight countries, not including Great Britain or any of her Dominions, are equipped with this machine. The training machines that have brought fame to England are those constructed by the well-known firm of A. V. Roe & Co. Ltd. It is probable that more pilots have been trained on Avro machines than on any other type of training machine in the world.

Models included in the No. 2 Outfit naturally are more elaborate than those in the smaller set and a much greater variety of types of machines may be constructed. The range includes triple-engined air liners, both of the biplane and monoplane types, seaplanes, sesquiplanes, flying boats and several types of military aircraft.

It is a well-known fact that aircraft designers of to-day are placing more faith in multi-engined machines, particularly for commercial air line work, and six of the models illustrated in the No. 2 Manual are of the multi-engined type. One of these is a triple-engined air liner similar to the Armstrong Whitworth "Argosy" used on the cross-Channel services of Imperial Airways Ltd. Another famous type is the triple-engined cabin monoplane that has been made famous by the Fokker Company and Air Commodore Kingsford-Smith, whose "*Southern Cross*" is of this type.

All aircraft of the multi-engined type are naturally safer to fly than single-engined machines, for if one of the engines should fail the other two will enable the journey to be proceeded with until a safe spot can be found for a landing. A hurried forced landing may often end disastrously when flying over land, but seaplanes and flying boats are usually able to alight on the surface of the water over which they are flying, except during stormy weather. There is, however, the danger that if the seaplane is not found very quickly a storm may spring up, in which case the machine will undoubtedly be sunk. If the seaplane is flying over seas that are not on the general trade routes a forced descent might result in death by starvation for the occupants. It will thus be seen that multi-engined machines are preferable for service on either land or sea.

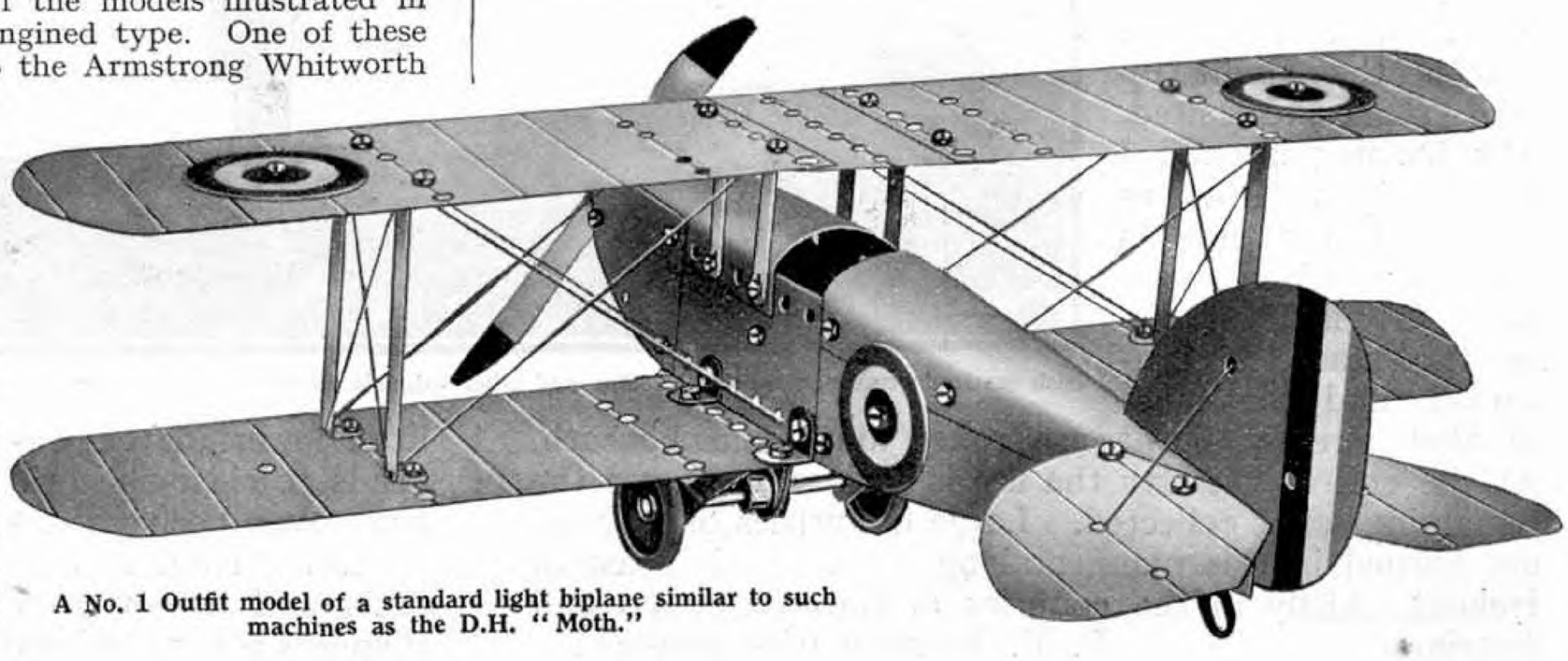
Other models illustrated in the No. 2 Manual therefore include flying boats, and amphibians, which are machines designed to alight either on land or water, and are fitted with one, two, or three engines. A model based on the Short "Valetta" is also included.

A particularly interesting model shows a monoplane seaplane similar to the types of machines designed for the famous Schneider Trophy Contests, and one of which has recently set up a world's record of 408.8 m.p.h. Another seaplane is a light machine. Most light aeroplanes, such as the D.H. "Moth" or Blackburn "Bluebird," may be obtained equipped either with a wheel undercarriage for land work, or with floats to enable the machine to operate from water. The fitting of floats to a light aeroplane appreciably reduces the maximum speed and makes the machine more difficult to fly. In many cases, however, a seaplane is much safer to fly than a landplane, particularly over country such as exists in many parts of Canada, where there is usually a stretch of water on which a pilot can alight in an emergency, but where the land is often totally unsuitable on account of trees and rocks.

Among the military machines that may be built with the larger Meccano Aeroplane Constructor is an interesting single-seater fighter and a general-purpose machine specially designed so that it can be adapted for various military purposes with the minimum of alteration. There is also an Italian bomber, a most unusual-looking machine, for the fuselage is low on the ground and the upper wing is much shorter than the lower one. This is the largest bombing machine at present in existence, and it has broken six world's records.

The models shown in the manual are not by any means the only ones that can be built with the Outfits, for by altering the disposition of the planes or by adding different types of engines, models can be based on numerous prototypes. Thus every time a boy sees a photograph of a new type of machine published in the "*M.M.*" he should endeavour to build it with the parts already in his possession. In this manner aeroplane enthusiasts will find that the Outfits provide the material for hours of unlimited pleasure and instruction, for they will be able to experience the delight of keeping up with the leading aeronautical engineers and aircraft designers by building models of the new machines as they are completed.

In order to make the model aeroplanes more realistic two special clockwork motors have been produced to fit into the nose of a machine. The smaller one is powerful enough to revolve the airscrew in a realistic manner, while the larger one is sufficiently powerful not only to make the airscrew revolve, but also to cause the machine to taxi slowly about the floor or table.



A No. 1 Outfit model of a standard light biplane similar to such machines as the D.H. "Moth."

From Our Readers

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Seaweed Burning on the Irish Coast

When travelling recently through a remote district of County Galway, Ireland, I was interested to come across a group of people engaged in burning seaweed. I learned from them that the ashes are used in the manufacture of iodine and other valuable products. The men told me that they get as much as £7 or £8 for a ton of the ash. A considerable amount of the raw material must be burnt in order to obtain sufficient ash to fill a sack, however, and as this substance is very light there is a large number of sacks to the ton.



A scene on the coast of Galway. Seaweed collected on the shore is being brought up to be burned.

The seaweed is collected all the year round, but the real harvest time is September, when Atlantic storms throw up immense quantities of seaweed that has grown below low water level, for this is richest in iodine. Children collect the seaweed, bringing it up from the shore in panniers slung on the backs of donkeys. The panniers are woven from willow stems, and no cabin in the collecting area is complete without a plantation of the shrubs from which the stems are obtained.

The men are responsible for the burning of the seaweed, for this requires expert control if the iodine is not to be vaporised and lost. The seaweed is first dried by storage in pens, and is then built up into a stack and ignited. The burning is carried on slowly and at as low a temperature as possible. More seaweed is piled on top as the stack is consumed, and the ashes of that already burnt are raked out from beneath. At the end of the day the fire is extinguished and the remaining ash is collected. Large quantities of seaweed are burned in this manner along the Atlantic coast of Ireland, chiefly in the counties of Galway, Mayo and Antrim.



Irish seaweed burners at work. Iodine and other valuable products are extracted from the ash.

P. E. MYTTON (Groomsport).

An Interesting Scottish Railway

The majority of readers of the "*M.M.*" probably are not aware of the existence of the Dumbarton and Balloch Joint Railway Company. In addition to a railway, this company owns a fleet of passenger steamers that ply on Loch Lomond.

The line from Dumbarton on the Clyde to Balloch on Loch Lomond is only five miles in length, and serves five stations in its course. The L.N.E.R. and L.M.S.R. now work the railway jointly, and it is a common occurrence to see an L.M.S.R. engine hauling a train of L.N.E.R. coaches, supervised by an L.M.S.R. guard. The employees of the line wear no special uniform, but the ships' crews have the inscription "D. & B.J.R.Co." embroidered on their jerseys.

The steamers owned by the D. & B.R. are dainty little craft with pink funnels and silver-grey hulls. They sail from Balloch to Ardlui, at the head of Loch Lomond, touching at five intermediate piers. The vessels were built on the Clyde, and when an attempt was made to take them up the Leven in order to reach Loch Lomond, it was found that their masts were slightly too tall to enable them to pass under a railway bridge spanning the river at Dumbarton. To overcome this difficulty the company invited pupils from neighbouring schools to come on board. Their weight had the desired effect, the vessels settling a little lower in the water and thus enabling the mastheads to clear the bridge. I wonder if school children have ever been used for a more remarkable purpose!

The head of Loch Lomond is among the Scottish mountains and a voyage there in one of the Company's steamers is very enjoyable.

J. THOMAS (Glasgow).

An East Indian Festival in Trinidad

There are many East Indians in Trinidad, where they were introduced in 1845 to supply labour for the sugar plantations during a shortage that followed the abolition of slavery. They are of course Mohammedans, and every year they celebrate a picturesque festival in memory of Hosein and Hassan, two grandsons of the prophet Mohammed.

As the time approaches for the celebration of the festival, the beating of tom-toms is heard at night in many parts of the island. The sound of these drums travels very far, and it is fascinating to watch the Indians vigorously beating them, one man with a big drum that is beaten with the palms of the hands, two with small drums, and another with a pair of cymbals. In the yards where the drums are beaten the noise is deafening. There is a heap of wood blazing near by, and occasionally, to tone them up, the drums are held close to the fire. It is a weird sight, the yellow firelight shining on dozens of dusky faces, and the tropical moon peeping through coconut branches overhead, with the air reeking of curry.



One of the " tajhas," or model temples, that are carried in procession during a Mohammedan festival celebrated by East Indians living in Trinidad.

The streets are crowded on the day of the festival itself, in spite of the fierce heat of the sun, heavily-laden motor-cars, omnibuses and carriages adding to the congestion. In the crowd are to be seen Negroes, Chinese and Portuguese, in addition to the East Indians themselves, for the inhabitants of Trinidad include representatives of nearly all nations.

The principal feature of the festival is a procession of model temples, or " tajhas," as they are called. These are made of bamboo or some other wood, tastefully covered with coloured paper, and are from 1 ft. to 20 ft. in height. They are typically oriental in design, and are ornamented with tiny objects that glitter in the sun. They are carried on the shoulders of Indian men or pushed about on wheels, and are usually followed by a crowd of Indian women, who throw rice on them and sing. Here and there may be seen men playing gatka, a form of stick-fighting. Others carry moons, crescent-shaped objects decorated with small mirrors and flowers, with which they dance among the crowd.

When the Hosein celebration is in full swing a multitude of sounds fill the air, shouts of " Hosein ! Hassan ! " the tooting of horns, and the booming of tom-toms. The festival comes to a close at about six o'clock in the evening. The end of the feast also is that of the tajhas, for these glittering temples are taken to the bank of the river, or to the seashore, and thrown into the water.

R. GARCIA (Trinidad).

The Snake Boy of Port Elizabeth

During a recent visit to the Snake Park at Port Elizabeth, I was interested in the remarkable manner in which the dangerous reptiles are handled by Johannes, a native attendant. Although he has been bitten fourteen times by poisonous snakes, Johannes has no fear of them. He has survived their venomous attacks with the aid of a snake-bite cure developed by Mr. F. W. FitzSimons, F.Z.S., the Director of the Park, and no doubt trusts to its being effective if he is again bitten.



A deadly necklace ! Johannes, the native attendant at the Snake Park, Port Elizabeth, exhibiting some of the poisonous snakes in his charge. Our photograph is by W. S. Hayward, Port Elizabeth.

The snakes are kept in pens surrounded by low brick walls, and moats prevent them from escaping. Almost every day Johannes calmly steps into one of the pens and collects a number of snakes by means of a hooked stick. He twists them about his head and neck and then stands still while eager visitors photograph the strange scene. Afterwards he moves on to the pens in which the pythons are kept. There he winds a 15-ft. monster about his body and neck, and casually remarks that although the python does not bite, it is easily able to crush a man to death.

It is not surprising to learn that Johannes is very popular with visitors, and he is said to be the most photographed native in the world. The snakes in the Park at Port Elizabeth include specimens of the cobra, the black mamba, the puff-adder, and other deadly creatures. The puff-adder is sullen and bad-tempered. Its poison is deadly but slow in working. The black mamba also is poisonous, and its bite is certain death unless anti-venom serum is available. Cape cobras are chiefly remarkable for their fondness for other snakes. On these they feed greedily, and if really hungry will not hesitate to attack even the large black mamba. D. L. RAMSAY (Port Elizabeth).

Breakdown Trains—*(Continued from page 859)*

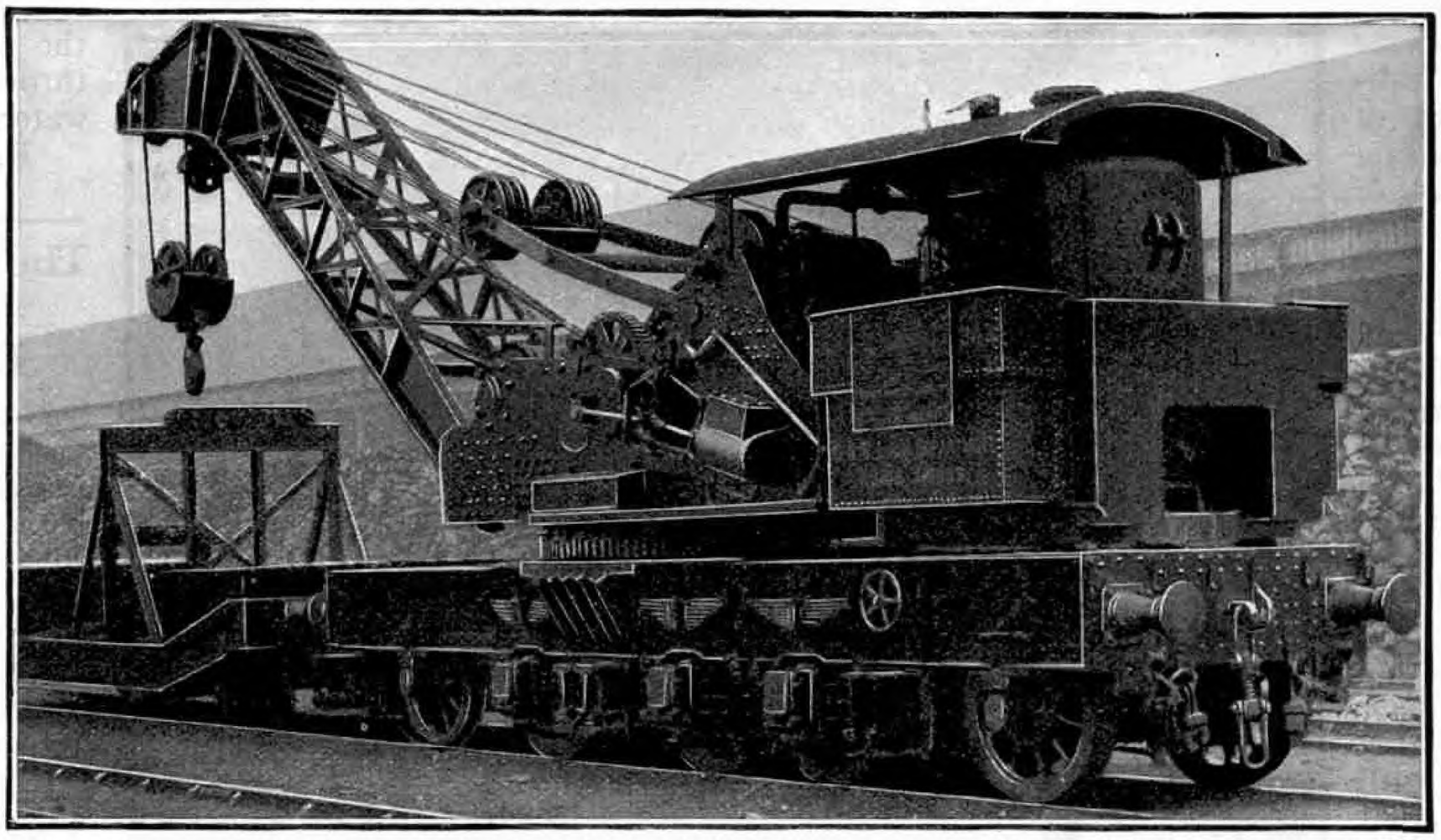
beyond repair, and repairing the sleepers and generally restoring the track to its normal condition. When the wreckage has been cleared and the track is again in order, any valuable debris that has to be left temporarily alongside the permanent way is covered with tarpaulins. The foreman sends word to headquarters that traffic on the line may be resumed, and the breakdown gang return to the depot.

In America breakdown cranes are known as "wreckers," and a mishap to the Western Night Mail that leaves Boston, Mass., at 11.30 p.m., provided an early opportunity to use a new large "wrecker" that had only been delivered by the makers the previous week. The crane caused astonishment by hauling itself and the cars of the breakdown crane to the scene of the accident, nine miles distant. The locomotive of the mail train had been overturned owing to the snapping of a defective fulcrum lever derailing the engine bogie, which caused the engine to topple over. The driver and fireman had jumped clear in the nick of time. With the assistance of another "wrecker" the locomotive was soon lifted back on to the track, and the first machine then created another mild sensation by returning to the depot under its own steam, towing the disabled engine along!

Three men are required to run this American crane, a fireman, a driver, and a man to transmit by whistle instructions from the foreman of the breakdown gang to the driver. The control levers that operate the jib, etc., are only 2 in. in height! This sounds extraordinary, but it is explained by the fact that every operation is controlled by compressed air provided by a single stage 9½ in. air compressor. The boiler is pressed at 190 lb. per sq. in. Electric light is provided from a turbo-generator using steam from the boiler. The tender of the crane has a capacity of 6,500 gallons of water and 10 tons of coal.

In addition to their usual employment in lifting derailed locomotives and rolling stock, breakdown cranes often are employed in connection with the normal routine work of the engineering department of a railway. For instance, when bridges are being built or renewed, breakdown cranes from the locomotive depots are frequently requisitioned in order that girders and other sections of steelwork may be dealt with easily.

It also may occur that at a small station bulky loads beyond the capacity of the local crane equipment are to be handled. In such cases the breakdown crane from the nearest depot is pressed into service.



A large Steam Breakdown Crane, with the jib raised above the Match Truck upon which it rests when not in use (see page 858). In "running trim," the jib is lowered in order to enable the Crane to pass under bridges across the line.

Modern Helicopters—*(Continued from page 887)*

machine constructed by the Marquis de Pescara was built as long ago as 1924. It weighed nearly a ton and was very crude, yet it established a closed circuit record for helicopters. The latest model weighs little more than 6 cwt., and has undergone successful trials in Barcelona, Spain, where its vertical rise from the ground is said to have caused great astonishment and enthusiasm among the onlookers. It is claimed that the machine is perfectly balanced when in the air, is capable of flying horizontally at an excellent speed, and makes vertical landings smoothly and gracefully.

So far we have dealt with machines that may strictly be described as helicopters, for they depend entirely on their horizontal airscrews for their lift. A machine that also makes use of the lift obtainable from the use of a light gas has been devised by M. Oehmichen, the French inventor. Its designer calls this machine a helicostat, a name that indicates it to be a combination of a balloon and a helicopter.

As our illustrations show, M. Oehmichen's machine consists of a small balloon below which is mounted a chassis. It is far from being merely a non-rigid airship, or blimp, however, for the capacity of the gas bag is nearly 14,000 cu. ft. which is much less than the 105,000 cu. ft. of the smallest vessel included in the French fleet of airships. The gas carried actually is insufficient in quantity to keep the machine suspended in the air, and it only contributes usefully to the lifting force available. It appears to be employed as a means of obtaining the advantages of the helicopter without the great expenditure of power necessary in ordinary machines of this class, and the engine fitted to the latest model of M. Oehmichen's machine is of only 40 h.p.

The chassis is fitted with four propellers. These work in pairs and may be inclined at varying angles, the two in front of the machine also being reversible. A propeller fitted in the ordinary manner is secured to the front of the chassis and is used in manœuvring on the ground. In order to take any strain that may be caused by a descent with the engine not running, four special landing legs are secured at the corners of the chassis. The rate of descent in these circumstances is not rapid, owing to the buoyancy of the balloon. It does not usually exceed 13 ft. per second, and successful vertical descents have been made from heights of 380 ft. Normally no strain is thrown on the landing gear, for the engine is switched on when contact is about to be made with the ground, the lifting effect of the airscrews then helping to bring the machine to rest without jarring. As the machine descends vertically and has practically no landing speed, it is not necessary to exercise great care in choosing ground on which to alight. This is an invaluable feature, particularly when the machine is in charge of an inexperienced pilot.

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Some General Hints

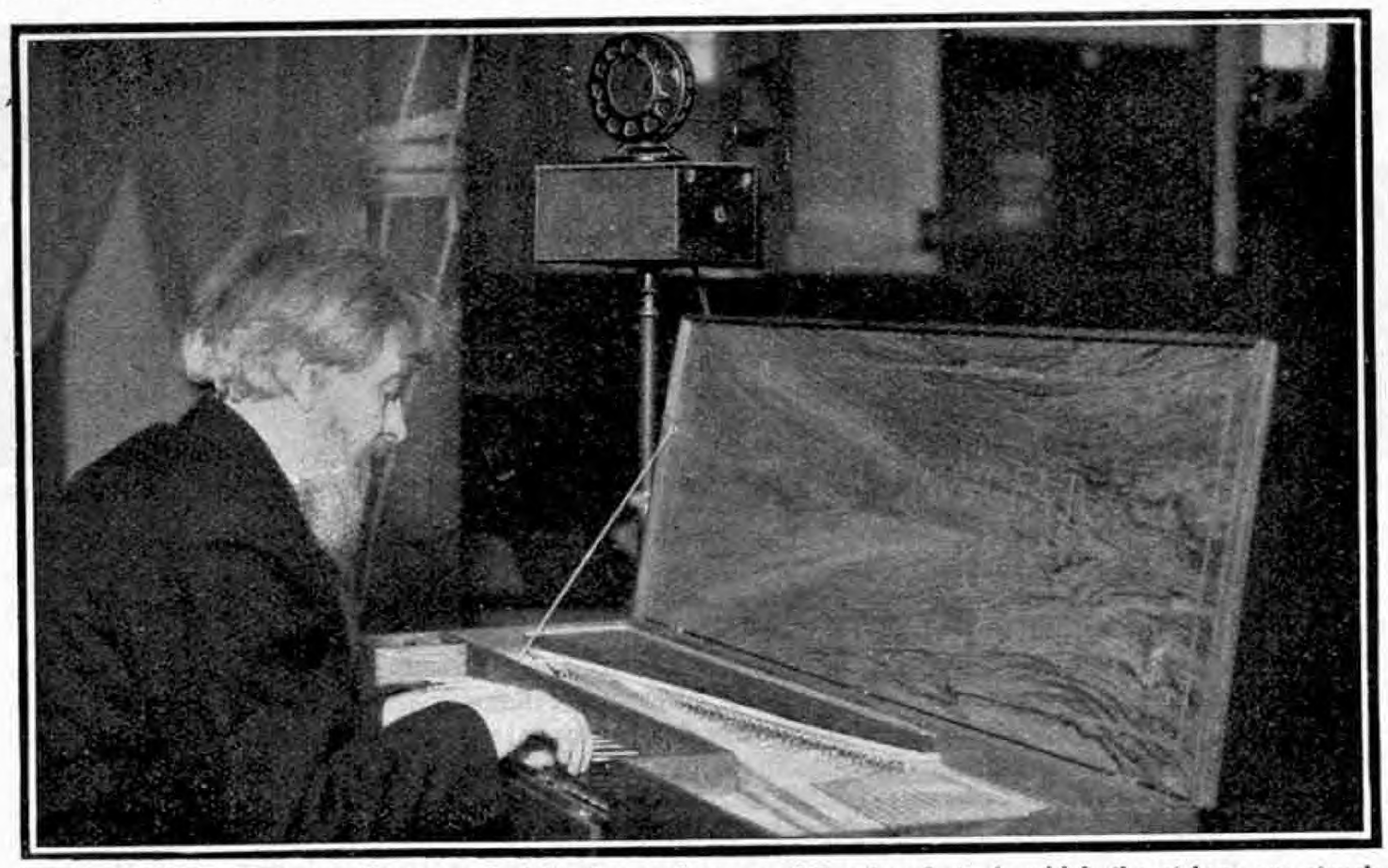
THE position in which a gramophone is placed is often determined by the shape of the room and the arrangement of the furniture. Generally speaking, however, the best position for the instrument is in one corner of the room; failing this, it should be placed with its back close up to one of the walls. The worst position of all is in the middle of the room. Wherever the instrument is placed it is important that it should stand firm and be perfectly level. If it is not level, the tone-arm will tend to swing either inward or outward during the playing of records, so that the needle will press unduly against one side or other of the grooves, instead of running freely and easily. There is a simple method of ascertaining whether the instrument is level or not. Select a record with a good expanse of plain surface either outside or inside the grooved area, or both. Then start up the record in the ordinary way, but let the needle rest in the centre of the plain surface. Any tendency of the tone-arm to swing will then be easily noticed. The next step is to adjust the instrument until this tendency is counteracted, which is easily done by placing small pieces of cardboard under one foot or other of the gramophone as required.

Most people wind up their gramophones while the motor is held still by means of the brake, but it is much better to allow the motor to run during winding. The winding handle should be turned evenly and steadily, the speed being slowed down as the increasing resistance indicates that the motor is becoming fully wound. Every gramophone motor is designed to play a certain number of records, and it should be allowed to play that number. Winding up afresh after the playing of each side is not only an unnecessary trouble, but also it has the bad result of causing one particular section of the spring to be used practically all the time, instead of the whole spring taking its share of the work. When the gramophone is finished with for the time being, the motor should be allowed to run almost, but not quite, down. The sound of the motor changes as it approaches the run-down condition, and this fact affords a reliable guide as to when to apply the brake.

Many gramophone brakes act far too fiercely, bringing the turntable to a stop with a sharp jerk. This is bad for the mechanism, and it is better to slow up the turntable gently with the fingers after each playing, before the brake is applied.

Every four or five months the motor should be thoroughly oiled. For all the bearings a light oil of good quality should be used, and Meccano Oil is excellent for the purpose. The teeth of the gear wheels require something thicker, such as light motor grease, or vaseline. Liquid oil must not be used for the worm on the governor shaft and the worm wheel on the spindle; these should be smeared lightly with vaseline. If the governor pad has become dirty, it should be cleaned with petrol on a piece of rag, and then be given just one or two drops of light oil. At longer intervals the spring barrels of the motor require attention. This is a dirty job, and the best plan usually is to have it done once a year or so by a competent mechanic.

All records are intended to be played at a definite speed, usually about 78 r.p.m., and if this speed is not adhered to the reproduction will suffer. The speed indicators on good-class gramophones are usually fairly accurate, but they should be tested and adjusted from time to time. Speed testers are sold by the Columbia and H.M.V. companies at 3/6 each.



Mr. Arnold Dolmetsch recording on a clavichord, a predecessor of the pianoforte, in which the strings are struck by brass pins projecting from the ends of the keys instead of by hammers. For this photograph we are indebted to the Columbia Graphophone Co. Ltd.

The Columbia "History of Music"

The accompanying photograph shows Mr. Arnold Dolmetsch recording a Bach prelude and fugue for the second volume of the splendid "History of Music" issued by the Columbia Company. This volume consists of eight records in an album, and a book of 32 pages. Musical history learned from a book in the ordinary way is apt to be dry, but it is quite a different thing when it is illustrated by records of the music of the compositions dealt with, played on the instruments used at that particular period. The old-time instruments featured in this new volume of records include the clavichord, the quaint instrument that was the predecessor of the pianoforte. The complete volume costs 28/–, but the eight records, without the book, can be had separately at 3/– each. These unique records will appeal to everybody who has the slightest interest in music, even if he cares nothing about its history.

Double-Track Record

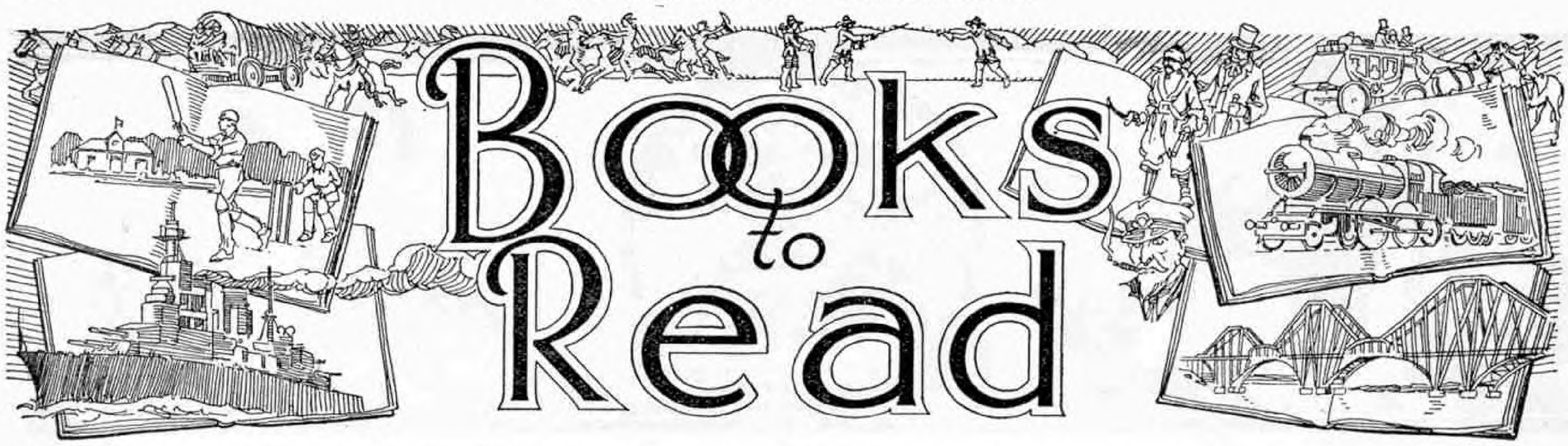
An interesting recent novelty is the Columbia double-track record DB567 (10 in. 2/6). This plays four different items, two on each side of the record, consisting of two Sousa marches played by the Royal Air Force Band, and two vocal items by The Maestros. We have had records previously with more than one item on each side, but they were "puzzle" records in that one never knew which tune would turn up next. In this record the exact point at which the needle must be placed to produce the item required is clearly indicated by letters on the outer edge of the disc. The recording is of the high standard that one associates with Columbia records, and the two sets of items are in pleasing contrast to each other.

* * *

It is almost always safe to buy the records made by Marek Weber and his orchestra, and this is the case with H.M.V. C2232 (12 in. 4/–), which gives on one side a pot-pourri of famous tunes, and on the other a fantasia on Russian melodies. One of my favourite records of this orchestra is H.M.V. B3527 (10 in. 2/6), consisting of two waltzes by Waldteufel, played with exhilarating brilliance.

* * * *

Among recent miscellaneous records the following are all well worth attention. *"Fun of the Fair"* (Regal MR367, 1/6) is a successful attempt to record a mammoth fair organ. It is strikingly realistic in the quality of tone, and it is not, as might be imagined, too noisy. *"Theatre Queue Entertainers"* (Broadcast 731, 9 in. 1/–) affords an opportunity for Sandy Powell's Mouth Organ Band to show their paces. This is a really amusing record and a remarkable shillingsworth. There is something about xylophone solos that appeals to most of us, and the Three Brothers Nehring provide a thoroughly exhilarating record (H.M.V. B3917, 2/6). The best recent banjo record is due to Phil Lennard, whose playing is quite remarkable for its precision and brilliance (Decca F3279, 1/6). Another astonishing feat of brilliant execution is given by Toni Lucassi in two marches played on the piano accordion (Imperial 2527, 1/3). Clapham and Dwyer are well up to their usual standard in *"The Royal and Ancient Game"* (Columbia DB570, 2/6), which consists of an amusing discussion and argument on golf in the well-known style of these comedians. Finally must be mentioned a remarkable yodelling record by George van Dusen, with orchestra (Parlophone R1000, 10 in. 2/6). The two items on this record, *"The Yodelling Romeo"* and *"Yodel-O-Eskimo,"* are very cleverly done.



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"The Romance of Million-Making"

By H. M. CRICHTON. (Published by Harrap. 7/6)

In these days, when there is so much talk about the departure from the gold standard and the fall of the £, any book that deals with the making of money must have a special interest. When it describes how money has been made in millions, its interest is all the greater.



The Tay Bridge built by Sir William Arrol, whose story is told in "The Romance of Million-Making" reviewed on this page.

It is in just such a book that Mr. Crichton shows us the more romantic aspects of the pursuit of riches. He tells true stories of men and women who have been raised from poverty to wealth by chance, fortune, and by hard work. The luck of the gaming tables; the bringing of treasure to light after long concealment in the earth or beneath the sea; fortunes made on the gold, diamond and oil fields, or in stocks and shares—all these find a place in this book. More laudable, however, are the stories of the men and women whose brains and industry have won rewards beyond the dreams of avarice.

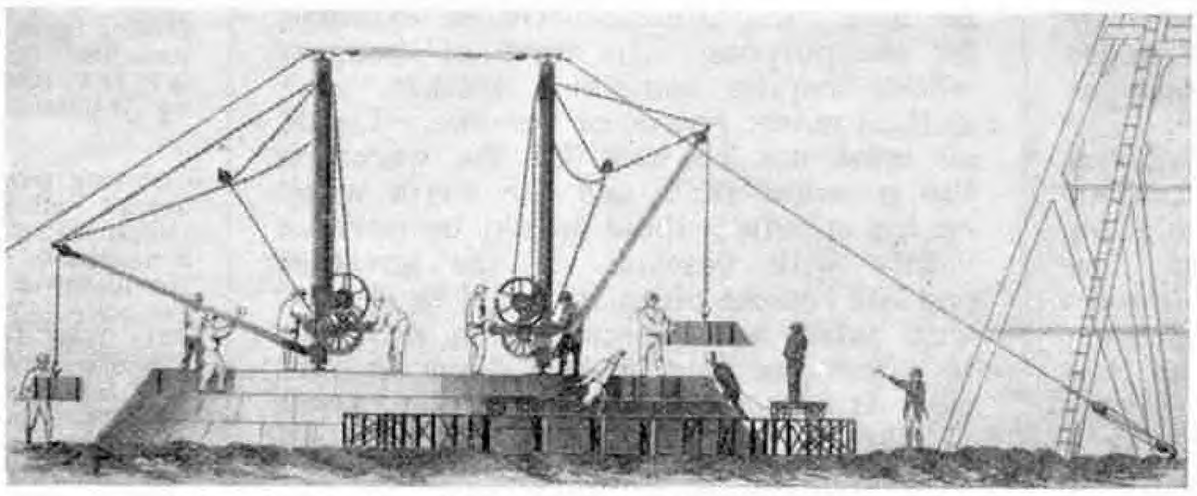
Such stories as these of the acquisition of wealth have no parallel in fiction for their dramatic and absorbing interest—we read how one-time counter assistants became knights, earls, or even dukes, or the ancestors of such nobility; of the romance of some of the great business houses of Britain; of how fortunes have been made from cocoa, soap, silk, cotton, steel and other commodities. What is of the greatest importance, however, is the fact that although luck does play a part in man's success, the attainment of wealth is mainly achieved not as the result of accident but by thrift, industry and high personal endeavour.

This is a book that both thrills and inspires, and we feel sure that it will be devoured by "boys" of all ages. It is well illustrated with 32 half-tone plates.

"The Book of Marionettes"

By H. H. JOSEPH. (George Allen & Unwin. 16/-)

Those of us who have been entertained on occasion by a marionette performance—even though it has been only the lowly "Punch and Judy"—welcome this opportunity of reading the story of these ingenious puppets. If we have imagined that puppet shows are some modern form of entertainment we are vastly mistaken, for their origin dates back to the earliest stages of the very oldest civilisations. Articulated idols were manipulated by ingenious devices in the temples of Ancient Egypt and India, and puppets were used through the classic centuries of Greece and Rome, and in the dark ages of early Christianity. They were found all over Mediæval Europe—in the cathedrals, along the highways, in the market places, and at the courts of kings. Past and present puppets are varied and innumerable and we cannot but admire the thoroughness with which the author has covered his ground—we are told of the puppets throughout the ages of the Orient, of Italy, France, Germany, England and America.



The works on the Bell Rock in September 1808. (See next page).

In our issue of January last we reviewed the "Book of Marionette Plays" (also published by Allen & Unwin), wherein are given five well-known plays suitable for puppet shows. In conjunction with the present book, this forms a fitting companion volume for those who require occupation for careful fingers and ingenious and patient brains. It is remarkable how few people realise the fascination of making and playing with marionettes. We are all apt to regard it as rather childish until we try it for ourselves, and then almost invariably we fall under the spell! It is a hobby that we can thoroughly recommend to all our readers, for it provides wide scope for skill in designing and making the quaint figures, and ingenuity in bringing them to life, as it were, and it is a hobby that is growing. Ten years ago there were only two or three marionette companies in America, but there are now so many enthusiastic followers that there is not a city or town in the United States, and scarcely a college or school, that has not its group of puppeteers. Even the simplest marionette production interests and amuses everybody if it is neatly carried out—each of the small puppets seems to develop a personality of its own, and we follow its career with sympathetic interest.

The book is well illustrated with photographs of puppets of all nationalities and as it is the first history of puppets ever written, its value to anyone seriously interested in the subject is undoubted.

"Houdini's Escapes"

By W. B. GIBSON
(Philip Allan. 10/6)

This is the first published record of the methods devised and used by Houdini, whose name will be well-known to many of our readers through his remarkable escapes from ropes, handcuffs, boxes, etc. In this book we are taken behind the scenes and are given in non-technical langauge many of the explanations of his seeming miracles.

Houdini, who has been described as the master showman of the 20th century, is

revealed as the enthusiast who believed he could escape from any known device. The escapes that he made in public included escapes from trunks, barrels, coffins, padlocked milk cans, and sometimes from boxes that were sunk in water. Once he even escaped from the torture devices of the Inquisition, and often he escaped from straitjackets and prison cells..

As the author points out in his introduction, there is a wide difference between the description of a trick or an escape, and its actual presentation. Properly exhibited on the stage even a simple device can become seemingly miraculous, and Houdini was a past master in introducing simplicity where his audiences looked for complexity.

He was often publicly challenged. On one occasion when appearing in London, he was challenged to escape from a tripod formed of three ladders from which he was to be suspended. His feet were to be roped to an iron ring in the floor of the stage, and his neck encircled with rope, the ends of which were to be tied to the top rungs of the ladders. An iron rod 3 ft. in length was to be passed behind his back, his arms crossed over it and his hands brought in front and tied at the wrists. Different parts of his body were to be lashed to the ladders so that he would be unable to move in any direction whatever. Houdini accepted the challenge and successfully made his escape under the conditions laid down. He had the gift of being able to use his toes as well as his fingers, and in escaping from this particular "tie-up" he slipped off his shoes, untied the knots with his toes, and so worked his feet and legs out of the rope that fastened them to the stage. To free his hands, arms and head was not difficult and his escape thereafter was easy. So effective was the escape that he often used the same "trick" in his subsequent exhibitions.

The book is divided into eight parts each of which is devoted to a different class of trick. It will not only help those who want to know how Houdini accomplished the seemingly impossible but it will also afford considerable satisfaction to those who are naturally curious.

"A Boy Scout with Byrd"

By P. Siple. (Putnams. 6/–)

Many of our readers, and especially those who are scouts, will remember the thrill they experienced when Commander Byrd announced that he intended to invite a scout to accompany his expedition to the South Pole. The boy who was selected was Paul Siple, the author of this book, and his story of his adventures is one that will be read with the keenest interest.

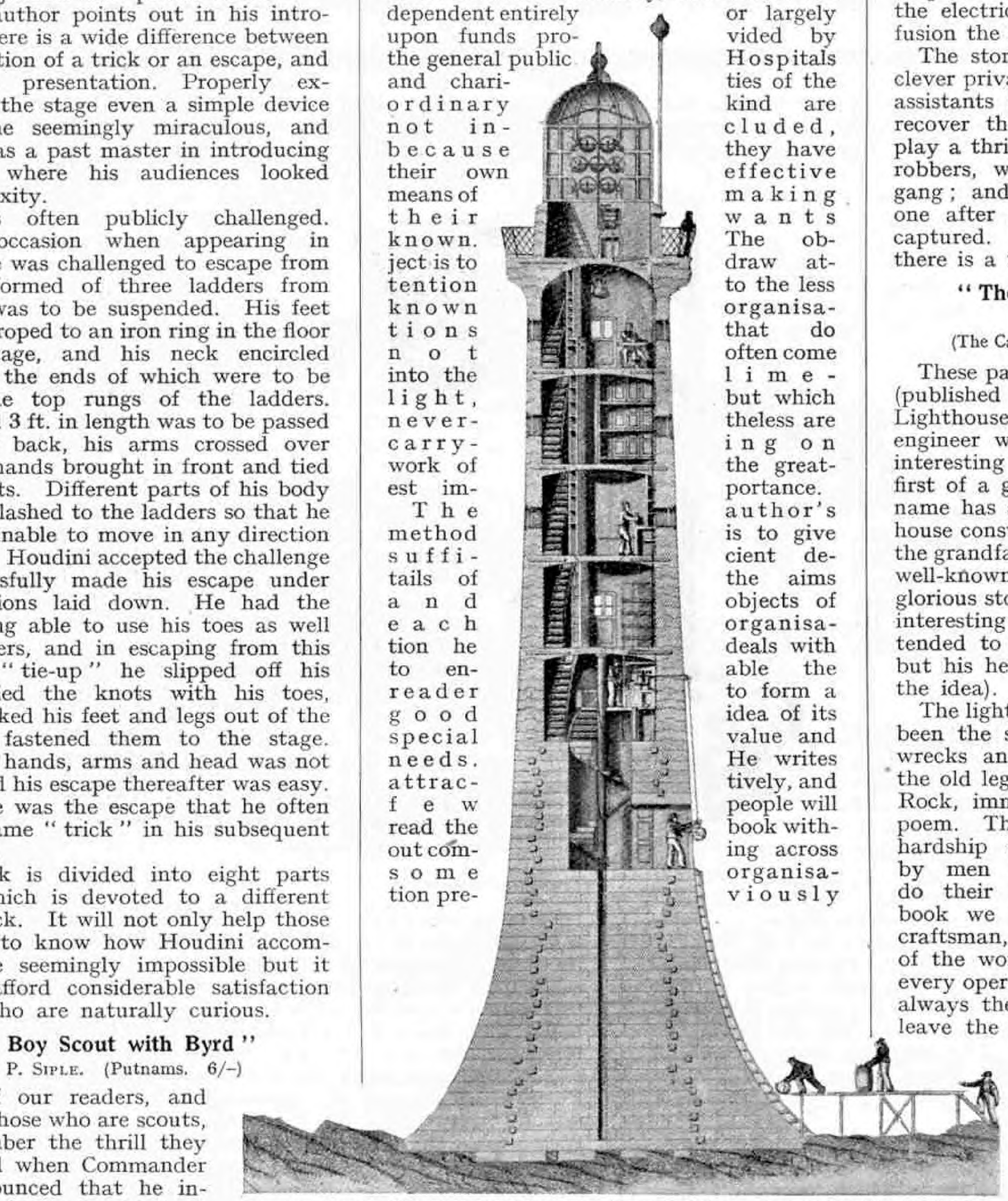
It was the first time that a boy had ever taken part in an adventure of this magnitude and Siple was the only junior member of the expedition. He spent eighteen exciting months in the Antarctic, where he was called upon to do "man-sized" jobs, at which he greatly distinguished himself and became a valued member of the staff. His comings and goings; his experiences when caught in a blizzard; the long winter night; the epic polar flight—all are delightfully described in his own words, and well illustrated with 33 photographs.

We are interested to see that a large part of the book is devoted to animal life—we read with delight of the huskies, the penguins and the seals, the chapter on the dogs being particularly interesting.

"Let's Help"

By Sir Charles Bright, F.R.S.E., M.Inst.C.E. (Routledge. 4/6 net)

In this unusual book Sir Charles Bright has attempted, and with success, to bring together reliable information on many societies and organisations that carry on useful work for the benefit of suffering or unfortunate humanity, and which are dependent entirely or largely upon funds provided by the general public and charitable Hospitals ordinary institutions of the kind are not included, because their own means of making wants known. The object is to draw attention to the less known organisations that do not come into the limelight, but which nevertheless are carrying on work of the greatest importance. The author's method is to give sufficient details of the aims and objects of each organisation he deals with to enable the reader to form a good idea of its special value and needs. He writes attractively, and few people will read the book without coming across some organisation previously unknown to them that makes a special appeal to their interests and sympathies.



A section of the Bell Rock Lighthouse on its completion. One of the illustrations in "The Bell Rock Lighthouse" reviewed on this page.

The book includes also an address by the Prince of Wales on the League of Nations, and an interesting wireless talk on "Bribery and Its Prevention" that Sir Charles Bright himself delivered some two years ago.

"David, the Chief Scout"

By Geo. A. Parkinson. (R.T.S. 3/6 net)

The life of David, the shepherd boy who became King of Israel, is a stirring story of heroism. Mr. Parkinson has told it in a very vigorous and attractive manner that should make a strong appeal to boys. It emphasizes the romance and adventure in the familiar Bible story and in addition shows how scout law and principle are illustrated by incidents in David's career. The result is a book full of thrills and excitement.

"The Boy Detectives"

By John G. Rowe. (Sharp. 3/6 net)

This is a story that will appeal to every boy who is interested in detective work. On a certain November evening the officials at a busy London Post Office had almost completed the sorting of the "Diamond Mail," in readiness for its despatch by the mail van, when suddenly the electric light failed, and in the confusion the mail was stolen.

The story is based on the efforts of a clever private detective and his two young assistants to round up the thieves and recover the stolen mail. The assistants play a thrilling part in tracking down the robbers, who prove to be a formidable gang; and exciting adventures follow fast one after another until the thieves are captured. The story is briskly told, and there is a thrill on almost every page.

"The Bell Rock Lighthouse"

By Robert Stevenson (The Cambridge University Press. 3/6)

These passages selected from an account (published in 1824) of the Bell Rock Lighthouse by Robert Stevenson, the engineer who constructed it, make most interesting reading. Stevenson was the first of a great family of engineers whose name has always been honoured in lighthouse construction. (Incidentally, he was the grandfather of Robert Louis Stevenson, well-known to all boys as the author of that glorious story "Treasure Island," and it is interesting to know that "R.L.S." intended to be a lighthouse engineer, too, but his health compelled him to give up the idea).

The lighthouse stands on a rock that had been the scene of many disastrous shipwrecks and which takes its name from the old legend of the bell of the Inchcape Rock, immortalised in Southey's famous poem. The record is one long tale of hardship and danger, cheerfully borne by men whose determination was to do their work well. Throughout the book we see Stevenson as the master craftsman, carefully planning every step of the work in advance; watching over every operation with the closest attention; always the first to land and the last to leave the Rock; and sharing his men's dangers and discomforts. It is no wonder that he was esteemed above all others by his workmen, and in reading the story we cannot fail to be impressed by his modesty and the singleness of purpose that enabled him to complete so great a task.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

"The Soul of a Dog"
by F. M. Archer (Churchman Publishing Co. Ltd. 2/6)

"Moving Forward"
by Henry Ford (The Associated Bookbuyers' Co. 8/6)

"The Autobiography of James Nasmyth" (Cambridge University Press, 3/6)

"The Ways of the Navy"
by Rear-Admiral D. Arnold-Forster (Ward, Lock & Co. Ltd. 7/6)

"The Quest for Power"
by H. P. & M. W. Vowles (Chapman & Hall. 15/–)

"The Standard Natural History"
by W. P. Pycraft (Warne & Co. Ltd. 15/–)

"Register of Civilian Aircraft"
by Manning & Preston. (Pitman. 2/6)

"Bird and Other Nature Problems"
by T. A. Coward. (Fredk. Warne)

"Opening Davy Jones's Locker"
by M. T. Williamson. (Harrap & Co. Ltd. 5/–)

"The Romance of Transport"
by Ellison Hawks. (Harraps. 7/6)

New Meccano Models

Ship Coaler—Tractor—Generating Unit—Crane—Loom—Bridge

ONE of the great advantages of the Meccano system is that each Outfit forms a complete model engineering equipment in itself, with which a wide range of engineering examples may be constructed.

Many fascinating models, such as blocksetting cranes, ship coalers, traction engines, etc., may be constructed with a No. 7 Outfit, but the Meccano boy does not have to buy a No. 7 Outfit before he can build models of these famous examples of engineering. Simple but none the less effective models of some of the largest and most complicated pieces of machinery may be reproduced with quite a small Outfit, and in our article this month we show how models of three of the best known No. 7 Outfit examples, the Ship Coaler, the Traction Engine, and the Blocksetting Crane may be reproduced with the smaller sets.

In addition, three other interesting new examples are included, these being a novel representation of a petrol-electric generating set, a simple hand loom, and a striking model of a cantilever bridge. The last-mentioned model forms a particularly good example of the way in which a large subject may be reproduced effectively on a small scale with few parts.

Ship Coaling Machine

The model Ship Coaler shown in Fig. 1 is of very simple construction, and naturally it does not reproduce the features of the prototype with the same degree of accuracy as the Meccano High-speed Ship Coaler, Super Model No. 2. In spite of this, however, it incorporates three of the main movements, namely, travelling of the grab trolley, hoisting of the grab, and travelling of the "discharge truck." The model is powered by a Meccano E1 Electric Motor.

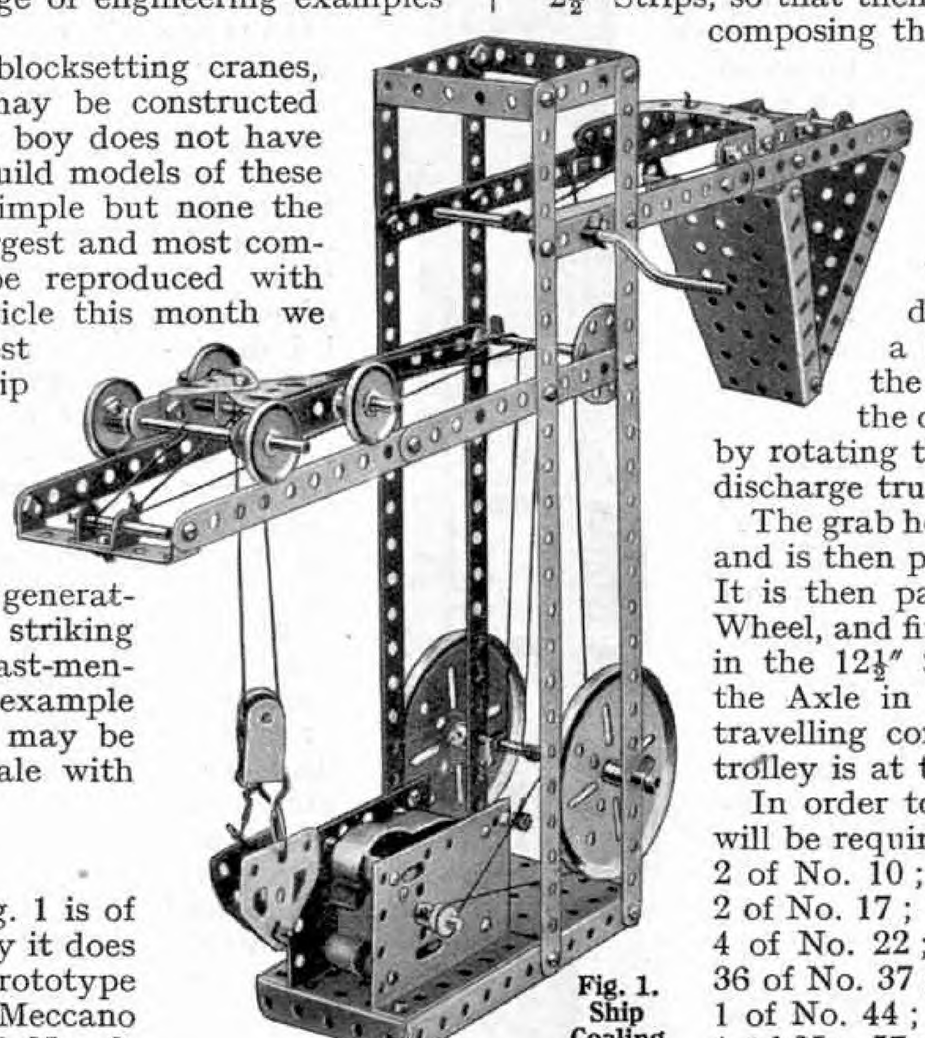


Fig. 1. Ship Coaling Machine.

The base of the model consists of a Meccano $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The E1 Motor is bolted to this Plate, and four $12\frac{1}{2}''$ Strips are also secured to the side flanges. The grab trolley runway consists of two composite strips, each built up from two $5\frac{1}{2}''$ Strips. The composite strips are spaced apart at the free end by means of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The composite strips are secured to the upright members, and a Bush Wheel is also secured in place to provide a support for an Axle Rod, around which the hoist and travelling cords are passed.

The grab trolley consists of two Trunnions, to which are bolted $2\frac{1}{2}''$ Strips. Two $3\frac{1}{2}''$ Axle Rods are journalled in the end holes of the $2\frac{1}{2}''$ Strips and carry 1" Fast Pulleys, which form the trolley wheels. A length of cord is attached loosely around the front axle of the trolley, and is then passed round a $1\frac{1}{2}''$ Rod mounted in a Double Bracket that is bolted to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Angle Strip at the outer end of the trolley runway. On leaving the Rod, the cord is passed round the Axle carried in the Bush Wheel and passed down to the $3\frac{1}{2}''$ Axle journalled in the upright $12\frac{1}{2}''$ Strips. The cord is wound round this Axle, passed once more over the Rod carried in the Bush Wheel, and attached loosely to the rear axle of the trolley. The "discharge truck" runway is also composed of two pairs of $5\frac{1}{2}''$ Strips. The "truck" is represented by two $2\frac{1}{2}''$ Strips held apart by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. Bolts are secured in the end holes of the $2\frac{1}{2}''$ Strips, so that their shanks can rest on the edges of the Strips composing the runway. Two Sector Plates are secured as shown in the illustration to form the discharge chute. The discharge truck is operated by a Crank Handle mounted between the upright Strips. The operating cord is first of all wound round the Crank Handle, and is tied to a Washer that is secured to the centre of the discharge truck. The cord then passes round a $1\frac{1}{2}''$ Axle mounted in a Double Bracket at the far end of the runway. The free ends of the cord are then tied together. In this manner, by rotating the Crank Handle it is possible to move the discharge truck up and down the runway.

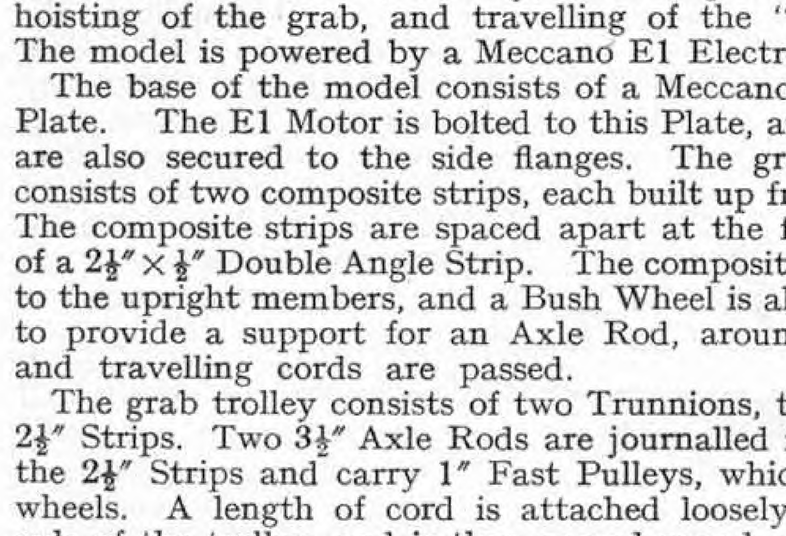


Fig. 2. Traction Engine.

The grab hoist cord is first of all tied to the grab trolley, and is then passed round the $\frac{1}{2}''$ loose Pulley of the grab. It is then passed round the Axle secured to the Bush Wheel, and finally is wound round the $3\frac{1}{2}''$ Axle journalled in the $12\frac{1}{2}''$ Strips. The cord should be wound round the Axle in an opposite direction to the grab trolley travelling cord, so that the grab is lowered when the trolley is at the far end of the runway.

In order to build the Ship Coaler the following parts will be required: 4 of No. 1; 8 of No. 2; 6 of No. 5; 2 of No. 10; 2 of No. 11; 2 of No. 12; 3 of No. 16; 2 of No. 17; 1 of No. 18a; 2 of No. 19b; 1 of No. 19s; 4 of No. 22; 1 of No. 23; 1 of No. 24; 5 of No. 35; 36 of No. 37; 6 of No. 37a; 8 of No. 38; 1 of No. 40; 1 of No. 44; 5 of No. 48a; 1 of No. 52; 2 of No. 54; 1 of No. 57; 6 of No. 111c; 2 of No. 126; 2 of No. 126a; 1 E1 Motor.

Traction Engine

Probably one of the most famous Meccano models constructed in recent years is the electrically-driven Traction Engine, Model No. 7.25. The splendid little model traction engine shown in Fig. 2 will appeal to those boys who have admired the larger model, but have not had the parts to build it.

The main frame of the model consists of $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, spaced apart by $2\frac{1}{2}''$ Strips. The Clockwork Motor is placed in between these, and is held in position by a $4\frac{1}{2}''$ Axle Rod, which passes through the perforations in the Motor side plates; this Rod also forms the rear road axle. The Motor is further anchored to the frame by means of a Double Bracket secured between the side plates at the front. The remainder of the frame is composed of $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and $1\frac{1}{2}''$ and $3\frac{1}{2}''$ Strips, the $1\frac{1}{2}''$ Strips being used to provide an opening for the Motor winding spindle.

The front road axle consists of a $4\frac{1}{2}''$ Rod mounted in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. A Pivot Bolt is pushed through the centre hole of this Strip and through the boss of a 1" Fast Pulley. The Bolt is then locked rigidly to the underside of the boiler by means of two nuts placed on either side of the lower Angle Strip. The 1" Fast Pulley is then pressed firmly against the Angle Strip, and the set-screw is driven home so that the Pivot Bolt is secured in position. In this way the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is clamped rigidly between the head of the Pivot Bolt and the face of the 1" Pulley.

A length of Cord is passed round the 1" Pulley of the front axle and is wound round a $3\frac{1}{2}''$ Axle Rod, as can be seen in the illustration. This Rod is mounted in

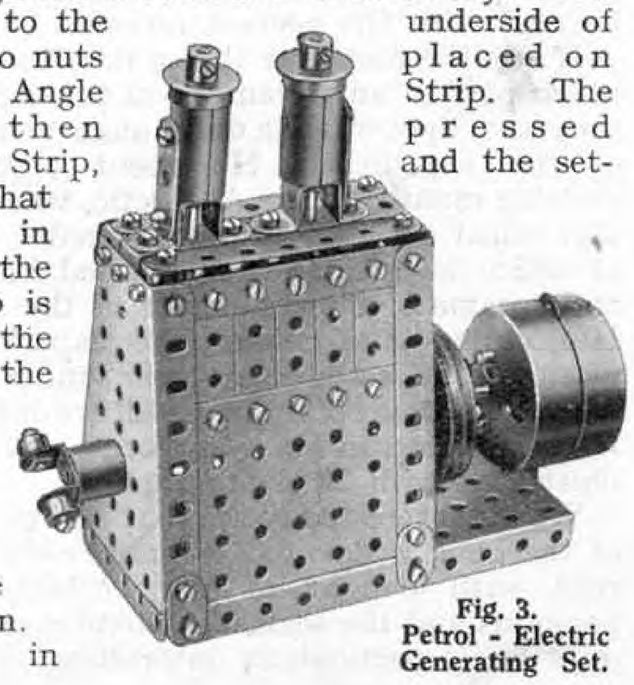


Fig. 3. Petrol - Electric Generating Set.

Angle Brackets secured to the frame of the model, and it carries a ½″ Pinion on one end. This Pinion meshes with a Worm mounted on the end of a Rod journalled in Double Brackets. The upper end of this Rod carries a 1″ loose Pulley, clamped between a Collar and a Spring Clip, and by rotating the Pulley, the front road wheels are steered to either the right or left side.

The parts that will be needed in the construction of the Meccano Traction Engine are :—1 of No. 2 ; 1 of No. 3 ; 2 of No. 4 ; 13 of No. 5 ; 2 of No. 6a ; 7 of No. 10 ; 4 of No. 11 ; 14 of No. 12 ; 4 of No. 12a ; 2 of No. 15a ; 4 of No. 16 ; 2 of No. 17 ; 2 of No. 18a ; 4 of No. 19b ; 2 of No. 20a ; 4 of No. 20b ; 1 of No. 21 ; 4 of No. 22 ; 1 of No. 22a ; 1 of No. 23 ; 1 of No. 24 ; 2 of No. 26 ; 1 of No. 32 ; 8 of No. 35 ; 72 of No. 37 ; 6 of No. 37a ; 13 of No. 38 ; 1 of No. 40 ; 1 of No. 44 ; 2 of No. 45 ; 1 of No. 46 ; 2 of No. 48 ; 10 of No. 48a ; 2 of No. 48b ; 1 of No. 53 ; 2 of No. 54 ; 4 of No. 59 ; 1 of No. 63 ; 2 of No. 111 ; 4 of No. 125 ; 2 of No. 126 ; 1 of No. 126a ; 1 of No. 147b ; 2 of No. 163 ; 1 of No. 164 ; No. 1 Clockwork Motor.

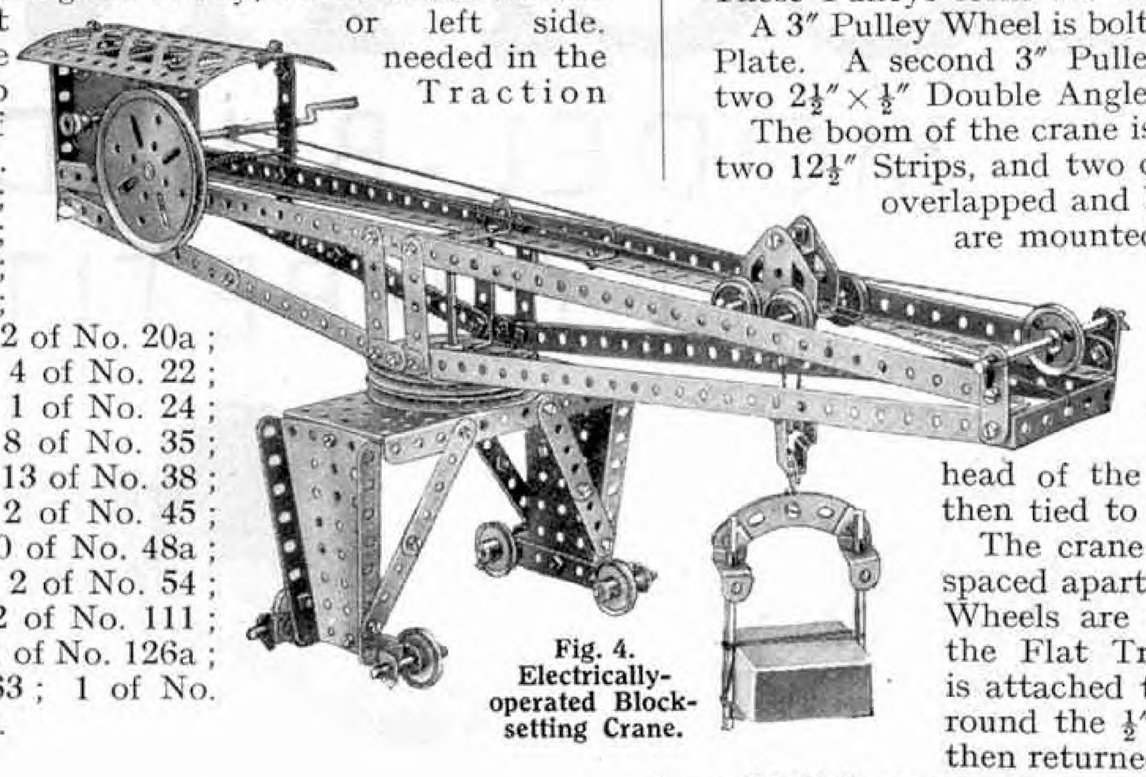


Fig. 4. Electrically-operated Block-setting Crane.

Generating Set

The model shown in Fig. 3 is of a novel subject, a petrol-electric generating set. Small petrol and heavy oil engines direct coupled to a dynamo are used extensively in small electric lighting installations, and our model represents equipment of this kind. The base of the model consists of a 5½″ × 2½″ Flanged Plate, to which are attached two Sector Plates by means of Flat Brackets as can be seen in Fig. 3. The spaces between the Sector Plates are filled in with 3½″ × 2½″ Flanged Plates and 2½″ Strips. The Sleeve Pieces, fitted with ¾″ Flanged Wheels, are mounted on Double Bent Strips, and a 1½″ Strip is used to secure further each Sleeve Piece.

The flywheel of the dummy crankshaft consists of two 2″ Pulley Wheels butted together. The crankshaft is provided at one end with a fork coupling, consisting of a large Fork Piece fitted with two Collars, a Chimney Adaptor being secured over the boss of the Fork Piece.

The dynamo is represented by two Boiler Ends held together by short Rods fitted with Spring Clips. These Rods pass through a 2½″ Strip, which is bolted to the base-plate of the model.

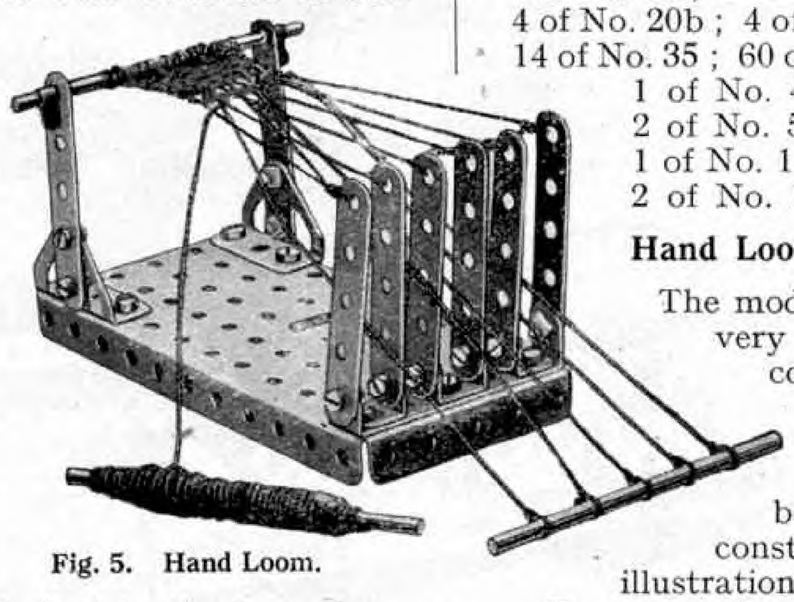


Fig. 5. Hand Loom.

In order to build the petrol-electric generating set, the following parts will be required : 5 of No. 3 ; 11 of No. 5 ; 2 of No. 6a ; 4 of No. 10 ; 4 of No. 12 ; 1 of No. 15 ; 2 of No. 16 ; 2 of No. 17 ; 2 of No. 20a ; 2 of No. 20b ; 4 of No. 35 ; 50 of No. 37 ; 2 of No. 37a ; 2 of No. 38 ; 2 of No. 45 ; 2 of No. 48b ; 1 of No. 52 ; 2 of No. 53 ; 2 of No. 54 ; 2 of No. 59 ; 2 of No. 111c ; 1 of No. 116 ; 2 of No. 162a ; 2 of No. 163 ; 1 of No. 164.

Blocksetting Crane

The Meccano Giant Blocksetting Crane, example No. 4 in the Super Model series, has the distinction of being the largest Meccano standard crane, and the great amount of mechanism included in it makes it one of the most interesting and instructive examples in the Super Model range.

The model blocksetting crane shown in Fig. 4 is very simple in design, but its main features bear a striking resemblance to the Super Model, and we feel sure it will be welcomed by many of the younger model-builders.

The travelling gantry of the crane is constructed from a 5½″ × 2½″ Flanged Plate and two Sector Plates. The gantry is braced by composite Strips composed of 2½″ Strips. A 2½″ × ½″ Double Angle Strip is secured to the lower end of each Sector Plate, and Double Brackets are attached to each end of these. A 1½″ Axle Rod is mounted in each Double Bracket and carries a 1″ fast Pulley. These Pulleys form the travelling wheels.

A 3″ Pulley Wheel is bolted to the centre of the 5½″ × 2½″ Flanged Plate. A second 3″ Pulley rests on this, and has secured to it two 2½″ × ½″ Double Angle Strips.

The boom of the crane is built up from four 12½″ Angle Girders, two 12½″ Strips, and two composite strips composed of 5½″ Strips overlapped and bolted together. Two 5½″ Braced Girders are mounted on 3½″ Strips over the Electric Motor to represent the roof of the operating cab. A Crank Handle is mounted in one of the 3½″ Strips supporting the roof, and a length of Cord is wound round this. One end of the Cord is passed round a 1″ loose Pulley at the head of the boom, and the ends of the Cord are then tied to the crane trolley.

The crane trolley consists of two Flat Trunnions spaced apart by a Double Bracket. Four ¾″ Flanged Wheels are mounted on short Rods journalled in the Flat Trunnions. One end of the hoist cord is attached to the crane trolley, and is then passed round the ½″ loose Pulley of the crane block. It is then returned to the winding shaft after passing over a ¾″ Bolt on the crane trolley. A 3″ Pulley is mounted on this shaft, and is coupled to the Motor pulley by means of an endless length of Cord.

The parts required for the block-setting crane are as follows : 2 of No. 1 ; 4 of No. 2 ; 2 of No. 3 ; 12 of No. 5 ; 2 of No. 6a ; 4 of No. 8 ; 4 of No. 10 ; 4 of No. 11 ; 8 of No. 12 ; 1 of No. 15a ; 4 of No. 16 ; 2 of No. 17 ; 4 of No. 18a ; 1 of No. 19s ; 3 of No. 19b ; 4 of No. 20b ; 4 of No. 22 ; 1 of No. 22a ; 1 of No. 23 ; 1 of No. 24 ; 14 of No. 35 ; 60 of No. 37 ; 6 of No. 37a ; 9 of No. 38 ; 1 of No. 40 ; 1 of No. 44 ; 1 of No. 48 ; 6 of No. 48a ; 1 of No. 52 ; 2 of No. 54 ; 1 of No. 57 ; 2 of No. 98a ; 2 of No. 100 ; 1 of No. 111 ; 6 of No. 111c ; 1 of No. 115 ; 3 of No. 125 ; 2 of No. 126a ; 1 E1 Electric Motor.

Hand Loom

The model shown in Fig. 5 represents what must be the very simplest form of loom. Although it is not, of course, possible to carry out elaborate weaving with this device, Meccano boys will no doubt be able to put it to practical use. The coarse woven material produced could, for instance, be used as the net in a model tennis court. The construction of the model will be clear from the illustration.

To operate the model the Axle Rod is merely raised and lowered alternately, and the shuttle carrying the weft thread is passed from side to side through the two sets of warp threads.

In order to build this model the following parts will be required : 8 of No. 5 ; 1 of No. 11 ; 2 of No. 12 ; 2 of No. 16 ; 1 of No. 17 ; 2 of No. 35 ; 16 of No. 37 ; 1 of No. 37a ; 1 of No. 48a ; 1 of No. 52 ; 1 of No. 111c ; 2 of No. 126.

Cantilever Bridge

The final example to be shown this month is a bridge of the cantilever pattern. The model would look effective in a Hornby layout. It is very simple to build.

The bases of the piers or pylons consist of 3½″ × 2½″ Flanged Plates, and four 12½″ Strips and four 12½″ Angle Girders are secured to each Plate. The roadway consists of a strip of cardboard bolted at the ends to the upper flanges of the 5½″ × 2½″ Flanged Plates, and supported in the centre by Angle Brackets. An Axle Rod is pushed through the Angle Girders forming the piers, so as to support the roadway at these points.

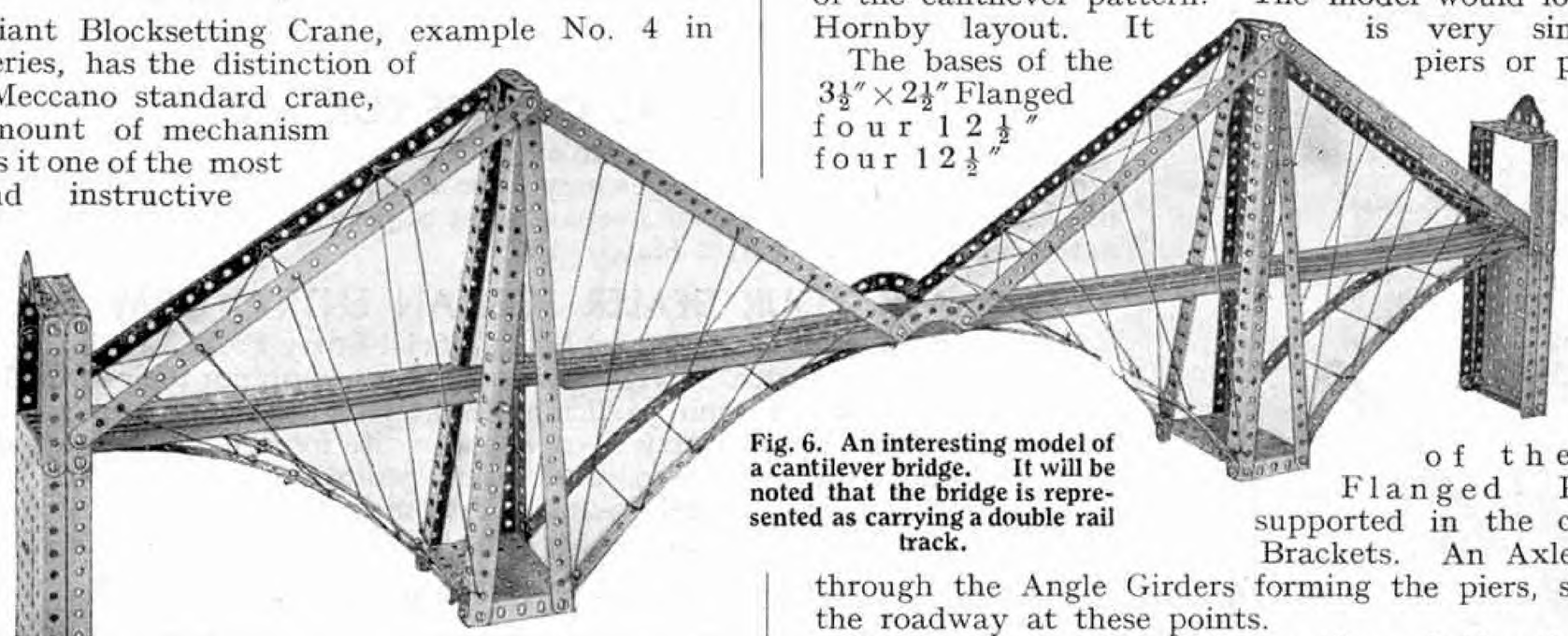
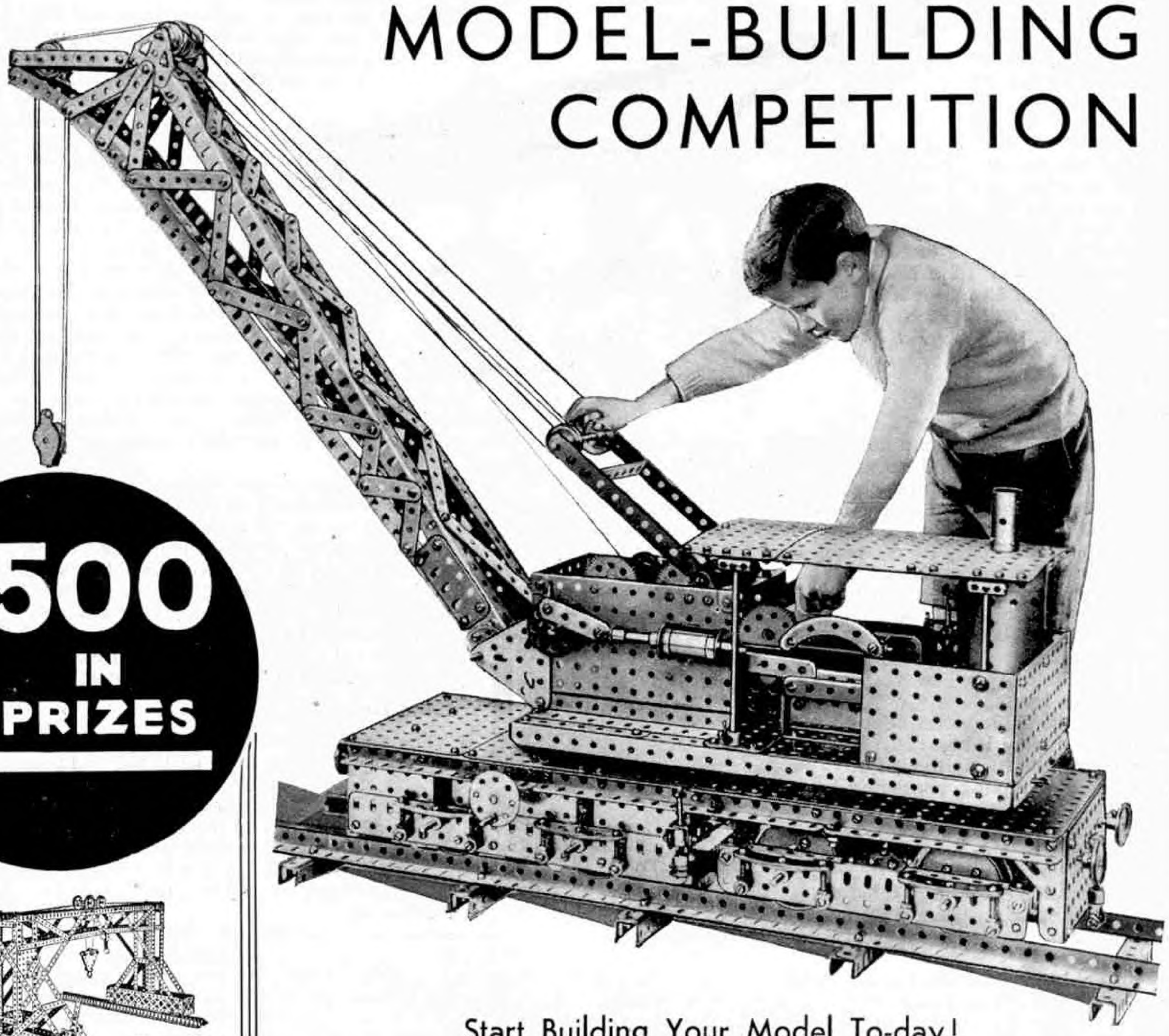


Fig. 6. An interesting model of a cantilever bridge. It will be noted that the bridge is represented as carrying a double rail track.

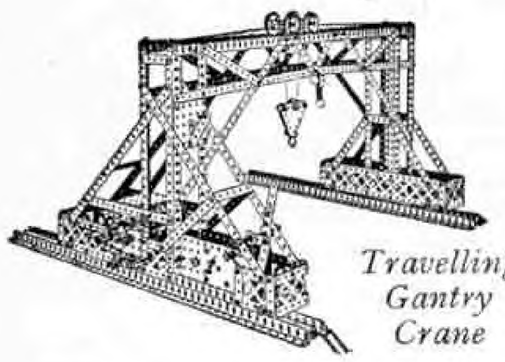
In the construction of the cantilever bridge the following parts will be required : 10 of No. 1 ; 16 of No. 2 ; 6 of No. 3 ; 6 of No. 5 ; 2 of No. 6a ; 8 of No. 8 ; 8 of No. 10 ; 12 of No. 12 ; 2 of No. 16 ; 4 of No. 35 ; 80 of No. 37 ; 3 of No. 40 ; 2 of No. 48 ; 6 of No. 48a ; 2 of No. 52 ; 2 of No. 53 ; 2 of No. 90a ; 2 of No. 126.

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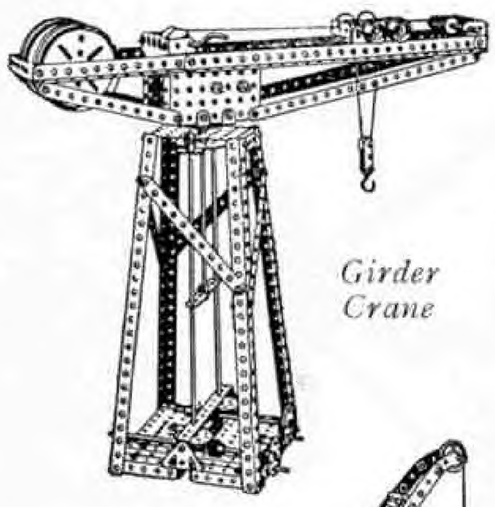
MODEL-BUILDING COMPETITION



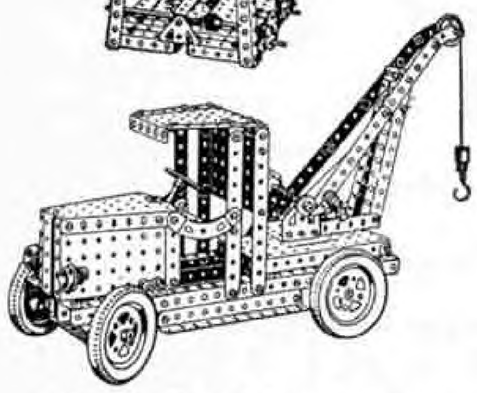
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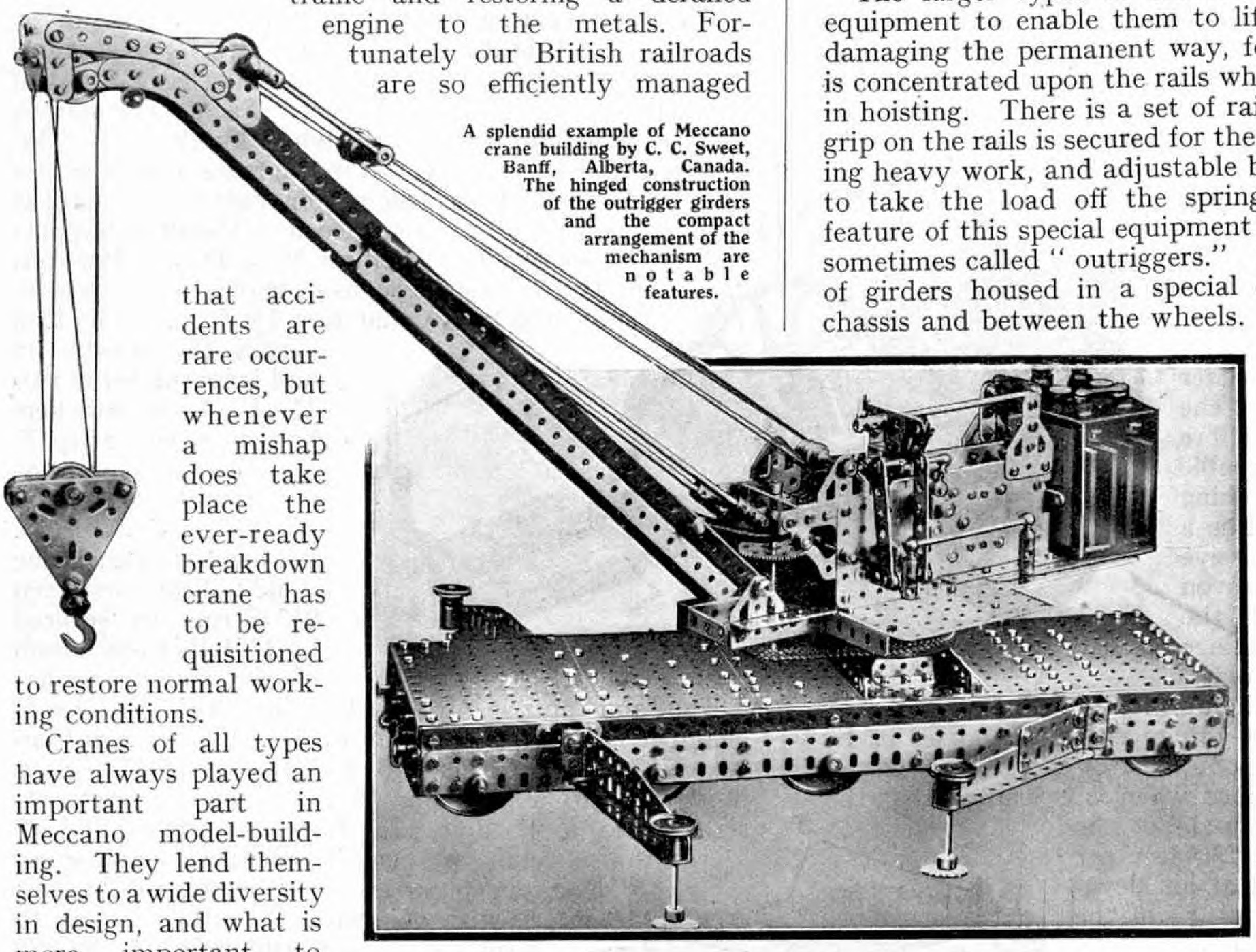
Closing Date: 31st March, 1932

MECCANO LTD. OLD SWAN LIVERPOOL

Breakdown Cranes in Meccano

Splendid Subjects for Model-Builders

ON our cover this month we illustrate a typical scene after a railway accident, showing breakdown cranes busily engaged in clearing the line for traffic and restoring a derailed engine to the metals. Fortunately our British railroads are so efficiently managed that accidents are rare occurrences, but whenever a mishap does take place the ever-ready breakdown crane has to be requisitioned to restore normal working conditions.



A splendid example of Meccano crane building by C. C. Sweet, Banff, Alberta, Canada. The hinged construction of the outrigger girders and the compact arrangement of the mechanism are notable features.

Cranes of all types have always played an important part in Meccano model-building. They lend themselves to a wide diversity in design, and what is more important to boys whose resources are strictly limited, may be reproduced with remarkable realism and accuracy even with small Outfits. From the Meccano point of view it is doubtful if any type of crane affords more scope for ingenuity and skill in design than the railway breakdown crane, a type that in the past has been somewhat neglected by model-builders. In this article we are giving a few details regarding the construction of the latest and most powerful cranes in use on British railways, in the hope of encouraging more boys to try their skill in building models of this type.

The development of high-speed running, and the increase in the size and tractive effort of locomotives generally, has resulted in the introduction of very powerful breakdown cranes, capable of lifting the heaviest engines. In some circumstances, however, two cranes working in conjunction as shown on our cover, are necessary.

Many of the cranes in use on British railways are capable of handling loads up to 80 tons, and they are so constructed that they can travel with ordinary rolling stock. They are fitted with self-propelling gear, but this is only for use at the scene of operations, and they are usually hauled along by means of a locomotive. Some of the latest types are driven by electric motors, but the majority employ steam power.

The larger types of cranes are fitted with special equipment to enable them to lift heavy loads without damaging the permanent way, for an enormous weight is concentrated upon the rails when the crane is engaged in hoisting. There is a set of rail clips by which a firm grip on the rails is secured for the crane prior to performing heavy work, and adjustable blocks are also provided to take the load off the springs. A very important feature of this special equipment is the blocking girders, sometimes called "outriggers." These are short lengths of girders housed in a special casing underneath the chassis and between the wheels. There are two girders to each side, and when required each is drawn outward and jacked up at the outer end so as to form an extended base to the crane and ensure stability and rigidity of the whole structure.

A splendid Meccano model in which this feature is incorporated appears on this page. The model was built by C. C. Sweet of Banff, Alberta, Canada, and is a typical example of what can be done by an ingenious model-builder who possesses a medium-sized Outfit. The arrangement of the outriggers differs from the method already described in that the girders, instead of being slidable inward and outward, are hinged to the frame itself. This method is quite satisfactory, but it is better practice, especially when dealing with heavy loads, to adopt the former method, as this obviates the great strain on the hinges and distributes the load more evenly.

Some of the very largest breakdown cranes are fitted with a special device known as Stokes' patent bogies. This consists of two four-wheeled bogies connected to each end of a longitudinal girder, which passes beneath the main crane chassis. The object of this arrangement is to temporarily increase the length of the wheelbase, in order to reduce the weight on the principal driving axles and lessen the stresses set up in bridges over which the crane may have to pass.

Readers who have sufficient parts at their disposal will find the Meccano Super Model Breakdown Crane, described in Special Instruction Leaflet No. 30, a most interesting subject. Boys who possess only a small Outfit should endeavour to build the simple model described under Model No. 3.55 in the No. 00-3 Instructions Manual.

New Meccano Model

6-inch Howitzer Equipped with Limber and Tractor

DURING the Great War howitzers were used to a very large extent in consequence of the change from open warfare, with which activities commenced, to the trench warfare that developed as the war progressed. Howitzers of 6″ and 8″ calibre as a general rule are easily capable of transport on their own carriages along ordinary roads or across fairly level country. For siege operations large calibres, entailing special means of transport, are necessary.

The particular howitzer forming the prototype of the Meccano model has a calibre of six inches and is capable of firing a projectile weighing 100 lbs. It is mounted on a field carriage of very massive construction, which runs on a pair of wheels of the ordinary heavy gun-carriage type. The total weight of the equipment, excluding the ammunition limber, is 3 tons 10 cwt., and it may be drawn either by horses or by mechanical traction. Some idea of the great power of this weapon will be gained when it is learned that the projectile leaves the muzzle of the gun at a velocity of 1,250 feet per second, and when fired at an elevation of 45 degrees the range of the gun is about 10,000 yards.

Construction of the model should be begun with the building of the Howitzer. The trailing girders and gun pivot support (Fig. 7) are built up from two $5\frac{1}{2}$″ Angle Girders connected by $\frac{1}{2}$″ Reversed Angle Brackets 11 to two $3\frac{1}{2}$″ Angle Girders. The $5\frac{1}{2}$″ Girders are connected together by the Strips 7 and 7a and the 1″ × 1″ Angle Brackets 8. The $3\frac{1}{2}$″ Angle Girders carry 3″ Strips 9 and $1\frac{1}{2}$″ Angle Girders 10, secured in the positions indicated in the illustration, to form extended bearings for the wheel axles. The gun proper is mounted pivotally in the 1″ Triangular Plates 30 (see Figs. 1 and 7) that are rigidly secured to the $3\frac{1}{2}$″ Angle Girders by $2\frac{1}{2}$″ Angle Girders.

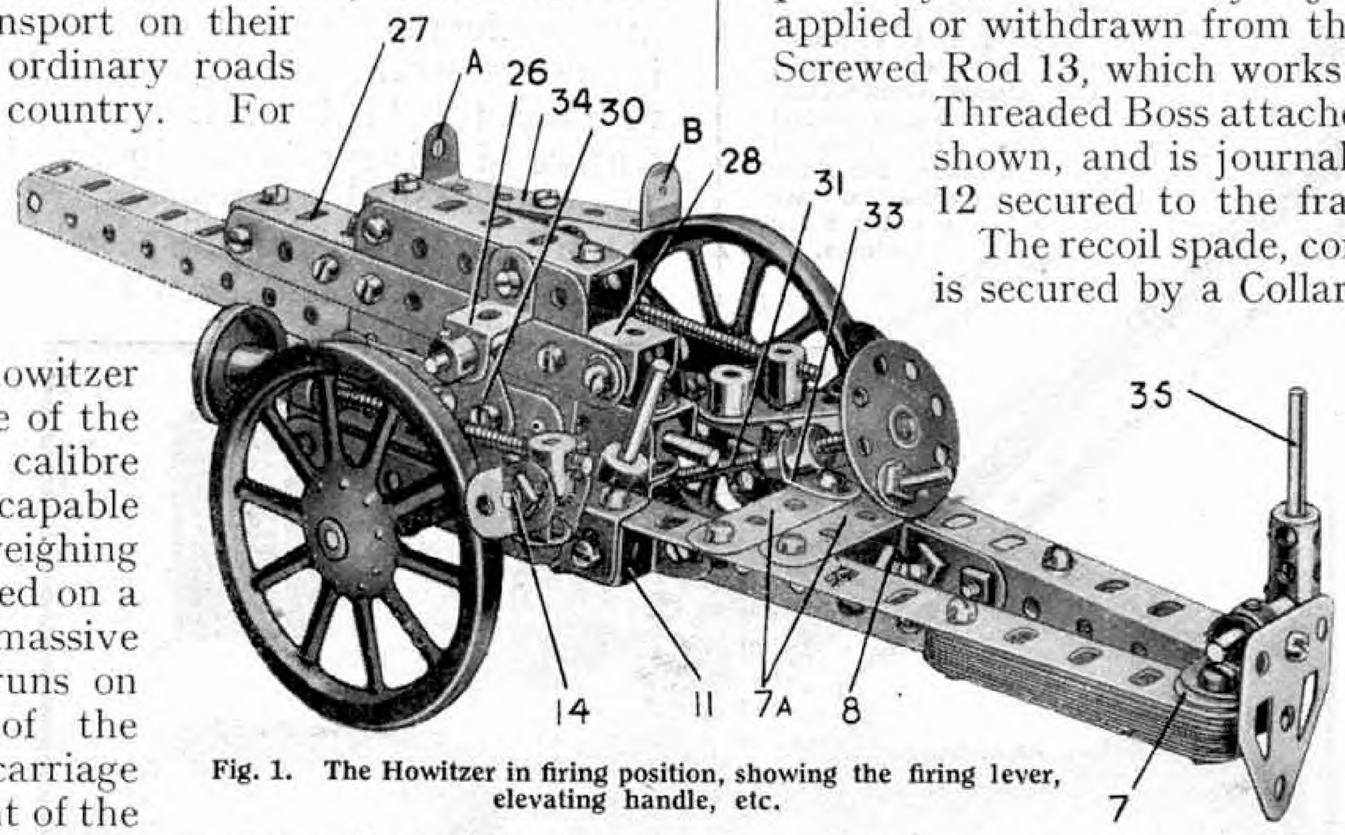


Fig. 1. The Howitzer in firing position, showing the firing lever, elevating handle, etc.

The brakes acting on the road wheels are built up as follows. Each brake shoe consists of two $\frac{1}{2}$″ × $\frac{1}{2}$″ Angle Brackets 14, which are secured to a Crank that is attached pivotally to the frame by a $\frac{3}{8}$″ Bolt. Each brake may be applied or withdrawn from the wheel by means of a $3\frac{1}{2}$″ Screwed Rod 13, which works in the transverse hole of a Threaded Boss attached pivotally to the Crank as shown, and is journalled in a Handrail Support 12 secured to the frame by a Double Bracket.

The recoil spade, consisting of a Flat Trunnion, is secured by a Collar to a $1\frac{1}{2}$″ Rod. This Rod carries the handle 35 and is journalled in two $\frac{1}{2}$″ × $\frac{1}{2}$″ Angle Brackets bolted to the Strip 7, the securing bolts passing through the rear end of the trailing girder. To counterbalance the weight of the barrel, ten $2\frac{1}{2}$″ Strips are secured by $\frac{3}{4}$″ Bolts to each limb of the trailing girder.

The gun muzzle, which together with the recoil chamber is shown sectionally in Fig. 6, is built up from two $7\frac{1}{2}$″ Angle Girders 15 and 15a secured at their inner ends to a Coupling 16 by means of three set-screws and a $\frac{3}{8}$″ Bolt 17. These set-screws and $\frac{3}{8}$″ Bolt also retain in place inside the Coupling an 8″ Rod, which carries two Compression Springs interlocked one with the other, so as to form a short, powerful spring. The end of one of the Springs is formed into a loop which serves to secure the Spring by means of a set-screw to the Collar 18.

The firing handle 19 (a $1\frac{1}{2}$″ Rod) is secured rigidly by a Coupling and $\frac{3}{4}$″ Bolt to a 2″ Strip that is attached pivotally to the Angle Bracket 20. The $\frac{3}{4}$″ Bolt slides in the elongated hole of another Angle Bracket 21, which is secured to the underside of the barrel and forms an efficient "stop" for the firing mechanism. Another

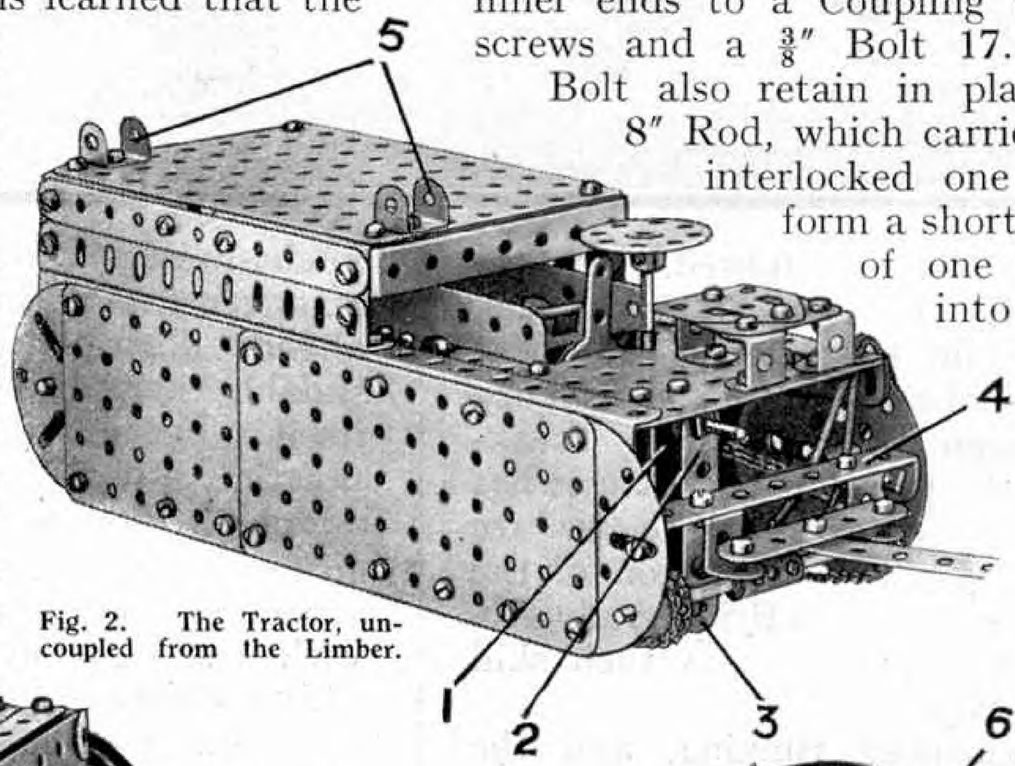


Fig. 2. The Tractor, uncoupled from the Limber.

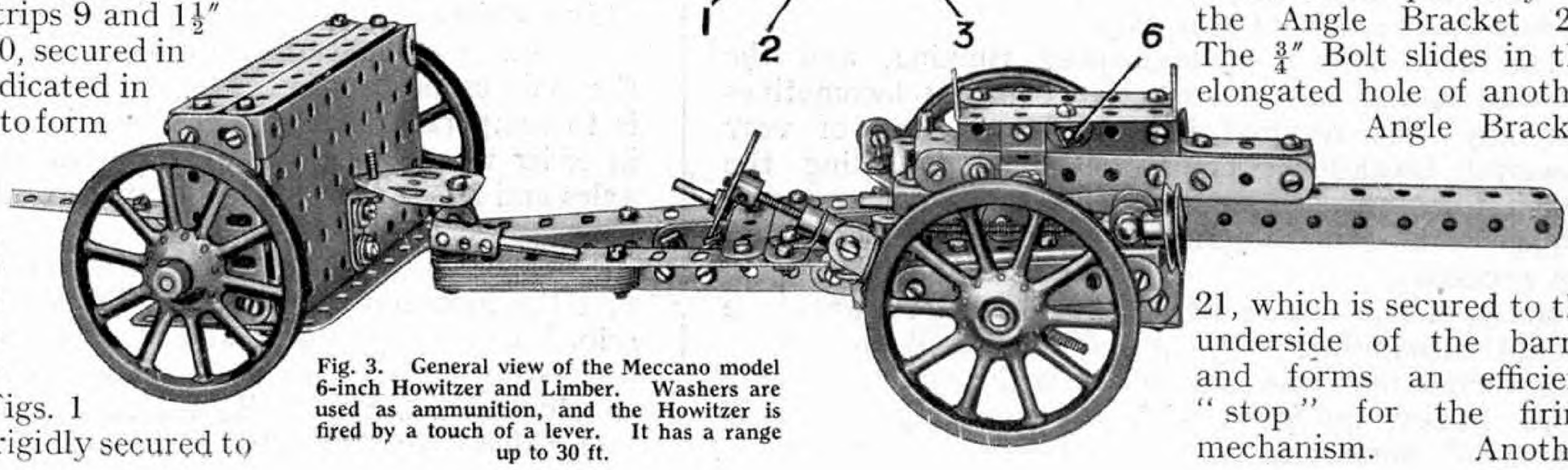


Fig. 3. General view of the Meccano model 6-inch Howitzer and Limber. Washers are used as ammunition, and the Howitzer is fired by a touch of a lever. It has a range up to 30 ft.

Coupling, secured to the 2″ Strip by the Bolt 36, carries a ¾″ Bolt 22, the end of which engages with the Washer (representing the shell) to be fired from the gun. Hence to discharge the gun, it is only necessary to apply a very slight lifting movement to the handle 19. The shot is pushed into position by a 7½″ Strip, which, when not in use, is carried in the Double Brackets 5 (Fig. 2) on the tractor. The complete gun barrel slides between the 2½″ Angle Girder 23 and the Angle Bracket 24, each of these parts being bolted to its respective side in the recoil chamber. The latter is constructed from two 2½″×2½″ Flat Plates joined together at top and bottom by 2½″ Angle Girders. Two ½″ Reversed Angle Brackets 26 (Fig. 1) and two 4½″ Strips 25 (Fig. 6) are bolted to the outside of the recoil chamber, and the 1½″ Angle Girder 27 and Double Bracket 28 are secured to the Strips 25 as shown in Fig. 6 to form a cover for the recoil spring, which is secured to the ⅜″ Bolts 17 and 29.

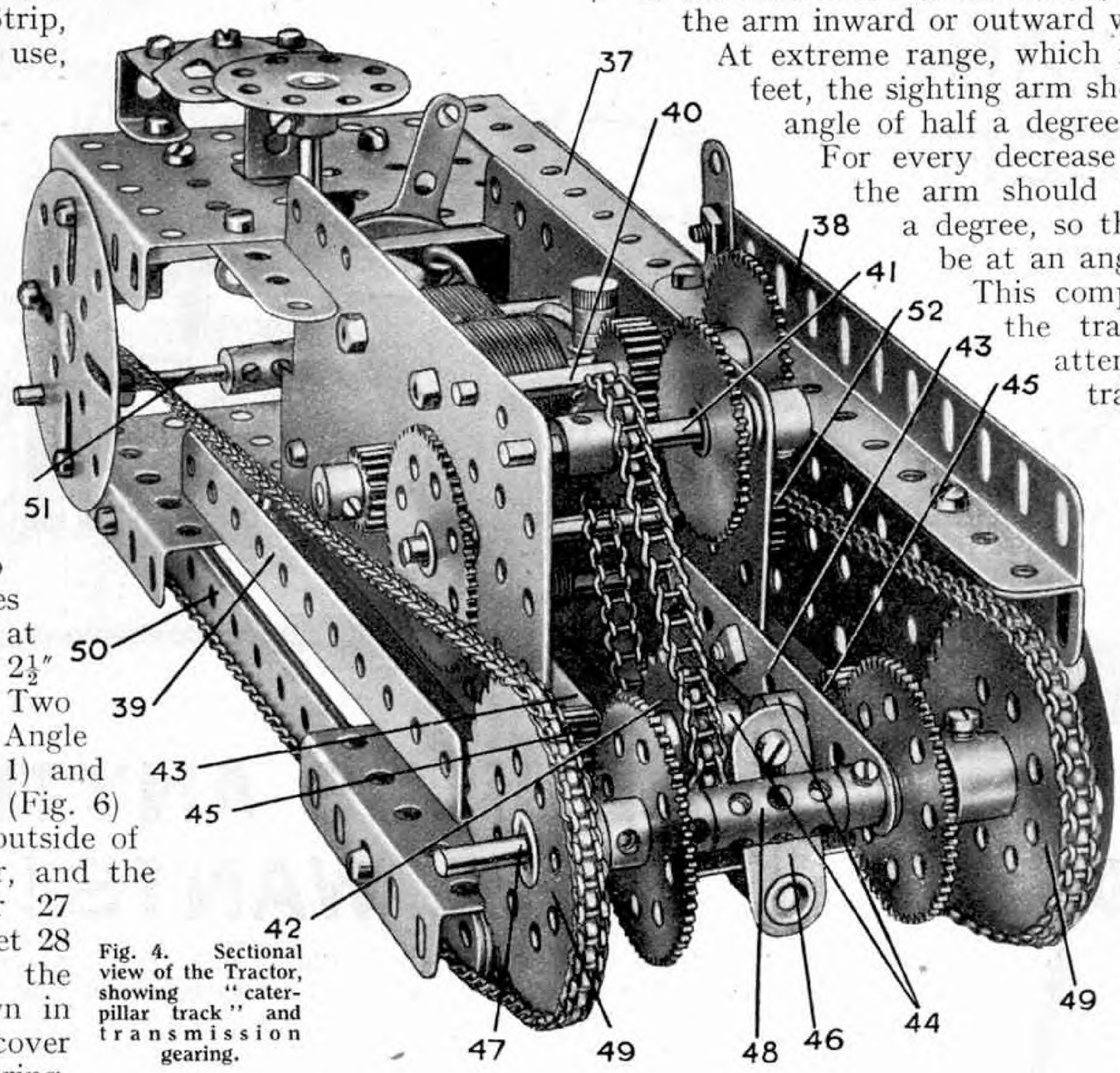


Fig. 4. Sectional view of the Tractor, showing "caterpillar track" and transmission gearing.

The recoil chamber with barrel in position is pivoted to the under-carriage by passing a 2½″ Rod through the 1″ Triangular Plates 30 (Fig. 7), and through the ½″ Reversed Angle Brackets 26 (Fig. 1) and the side plates of the recoil chamber, the whole being held in place by Collars.

The elevating apparatus consists chiefly of a 3½″ Threaded Rod 31 (Fig. 1), which carries at one end a Bush Wheel and is journalled at the other end in a Threaded Boss 32 (Fig. 6) that is attached pivotally to the lower corner of the recoil chamber. The Threaded Rod is prevented from moving laterally by two Collars clamped to the Rod, one on each side of an Angle Bracket 33 that is secured in the position indicated.

An efficient sighting apparatus is attached to the gun. The 2½″×½″ Double Angle Strip 34 (Fig. 1) is bolted to an Angle Bracket 6 (Fig. 3), and the latter is attached by lock-nuts (see Standard Mechanism No. 262) to the recoil chamber, so as to allow a fairly stiff swivelling movement. A very fine wire, about 36 S.W.G. is secured perpendicularly across the hole A and a piece of paper over the hole B, the paper having a pin hole punched in its centre. In view of the fact that the centre line of the sighting arm is to one side of the centre line of the barrel, it is necessary to move the arm inward or outward when altering the range. At extreme range, which is approximately thirty feet, the sighting arm should point inward at an angle of half a degree to its own centre line. For every decrease of 6 ft. in the range the arm should be moved inward half a degree, so that at 6 ft. range it will be at an angle of 2½ degrees.

This completes the Howitzer and the tractor may now receive attention. Each side of the tractor consists of two 5½″×2½″ Flat Plates over-lapped five holes, and two Face Plates, bolted one at each end. Four 3½″×2½″ Flanged Plates and one 3½″×½″ Double Angle Strip 4 (Fig. 2) are used to connect the two sides together, two of the Plates being used for the top and two for the bottom. The 3½″×½″ Double Angle Strip 4 is secured between the rear pair of Face Plates and carries two ½″ Reversed Angle Brackets. These are for use when coupling the gun limber to the tractor. The upper edge of each side carries a 9½″ Angle Girder 37 (Fig. 4) to which is bolted a 5½″ Angle Girder 38. Two further 5½″ Angle Girders 39 are bolted across the two lower 3½″×2½″ Flanged Plates and form a bed for the Electric Motor as shown.

The next stage is the assembling of the mechanism, which is carried out as follows. A ½″ Pinion on the Motor armature shaft engages with a 57-teeth Gear that is secured to a 2½″ Rod carrying a ¾″ Pinion 52. This Pinion meshes with a 50-teeth Gear on the Rod 40 and this Rod carries also a ¾″ Pinion that engages with a further 50-teeth Gear on the Rod 41 carrying a ¾″ Sprocket Wheel that is connected by Sprocket Chain to a 1″ Sprocket Wheel 42 on a slidable layshaft. The latter is journalled in two 3½″ Strips 43 that are bolted to the next-to-bottom row of holes in the Motor side plates as can be seen in Fig. 4.

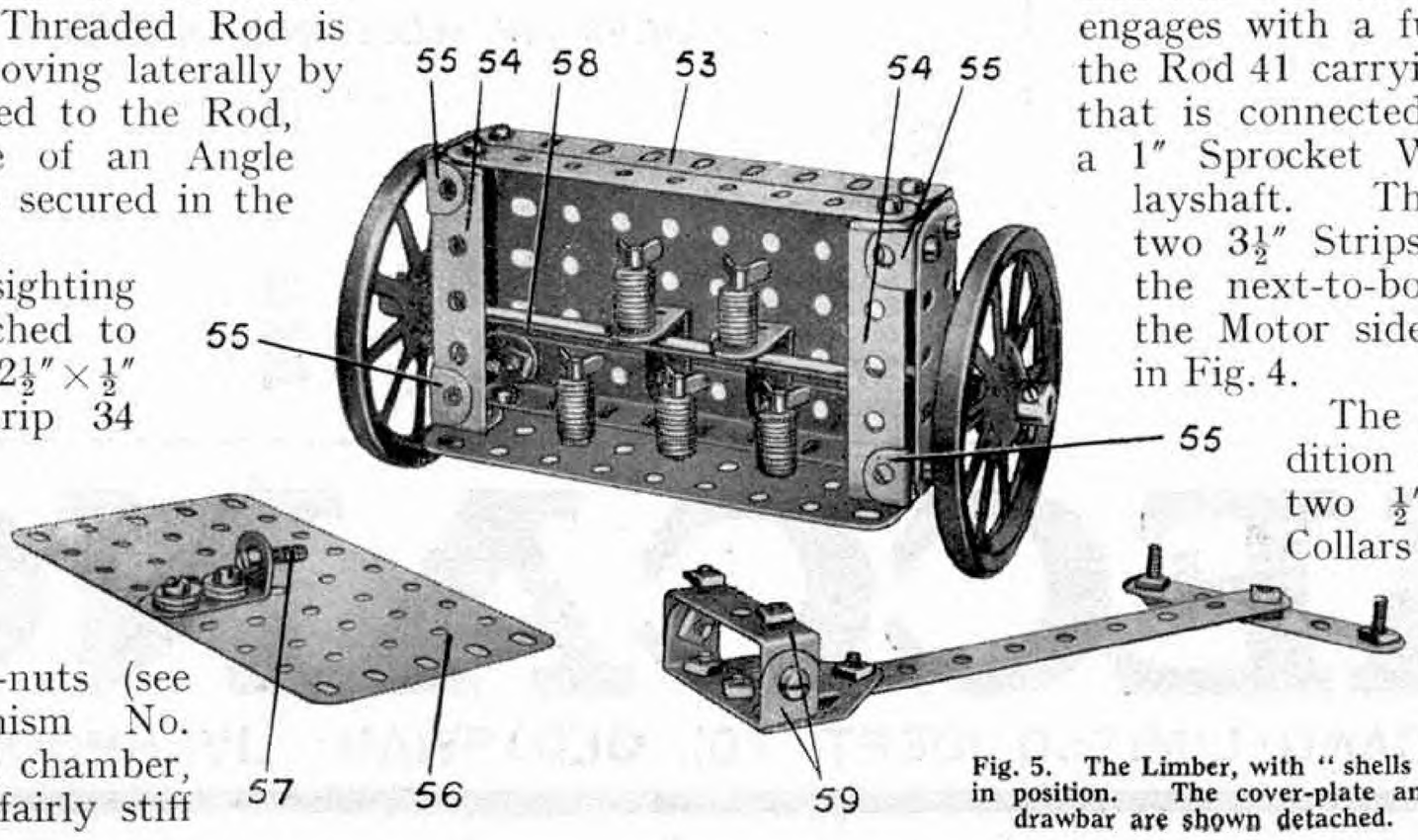


Fig. 5. The Limber, with "shells" in position. The cover-plate and drawbar are shown detached.

The layshaft carries, in addition to the 1″ Sprocket 42, two ½″ Pinions 45 and two Collars 44. The Pinions must be so spaced on the Rod as to engage the 57-teeth Gears either simultaneously or separately. The Gears are secured on

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each side of the split rod 47, each half of which is journalled in one of the Face Plates on the side of the model and in one of the Strips 43. The inner ends of the two halves of the rod 47 are carried in a Coupling 48. Each carries also a 2″ Sprocket Wheel, round which is passed a length of Sprocket Chain to form the "caterpillar" track. Each of the two chains passes round a ¾″ Sprocket Wheel that is loose on the Rod 51, and also along the lower edges of two 7½″ Strips 50 that are bolted face to face. The Strips 50 hold the tracks in contact with the ground. They are secured to the sides of the model by means of ¾″ Bolts, and are spaced from the sides by Collars.

The two Collars 44 on the lay-shaft are spaced apart so as to allow a set-screw, carried in the elongated hole of the Crank 46, to move easily in the intervening space. The Crank 46 is nipped on an 8″ Rod that is journalled in Angle Brackets bolted to the underside of the 3½″×2½″ Flanged Plates joining the sides of the tractor, and the opposite end of the Rod carries a second Crank 3 (Fig. 2) to which is secured a 2″ Strip 2 carrying a Threaded Pin in its upper end hole. The portion of the shank of the Threaded Pin that protrudes beyond the securing nut may be engaged when desired, with the hole in a ½″×½″ Angle Bracket 1, which is secured to the top casing of the tractor by a bolt through its elongated hole. When the Threaded Pin rests in the hole of the Angle Bracket both 57-teeth Gears are in engagement with the Pinions 45 (Fig. 4) but on moving the lever to the right the right-hand Pinion is thrown out of mesh while the left-hand Pinion remains in mesh, thus causing the tractor to make a right-hand turn. A left-hand turn is carried out by moving the lever 2 over to the left, thus disengaging the left-hand Pinion and bringing the right-hand Pinion into mesh with its appropriate 57-teeth Gear.

The engine cover consists chiefly of two 3½″×2½″ Flanged Plates connected together along their edges by means of 5½″ Strips and across the top by a 5½″×3½″ Flat Plate. The ends of the cover are fitted with 3½″×½″ Double Angle Strips; the front Double Angle Strip carries also a 3½″ Flat Girder. Two Double Brackets 5 (Fig. 2) are bolted to the 5½″×3½″ Flat Plate and the complete engine housing is secured by means of four Flat Brackets, to the Angle Girders 38 (Fig. 4).

The tractor is completed by the addition of a dummy steering wheel and driver's seat. The steering wheel consists of a Bush Wheel secured to a 5½″ Rod that is journalled in the rear end pair of 3½″×2½″ Flanged Plates (Fig. 4). The driver's seat comprises two Flat Trunnions bolted together to form a square, and secured to the rear of the tractor by means of three Double Brackets, the positions of which are shown clearly in Fig. 4.

The bottom of the Limber (Fig. 5) consists of a 4½″×2½″ Flat Plate, to which is bolted, by means of a 4½″ Angle Girder, a second similar Plate to form the back. A second 4½″ Angle Girder 53, bolted to the top edge of the latter plate, is connected by two Flat Brackets to a 4½″ Strip that, in turn, is secured to two 2½″×½″ Double Angle Strips 54, the other ends of which are secured to the bottom of the limber. Each side is enclosed by a 2½″ Flat Girder, which is secured by means of four ½″×½″ Angle Brackets to the top and bottom of the limber. The Flat Girders carry also four ½″×½″ Angle Brackets 55, these being spaced from the Double Angle Strips 54 by Washers so as to allow a 4½″×2½″ Flat Plate 56 (shown separately) to slide in the intervening space.

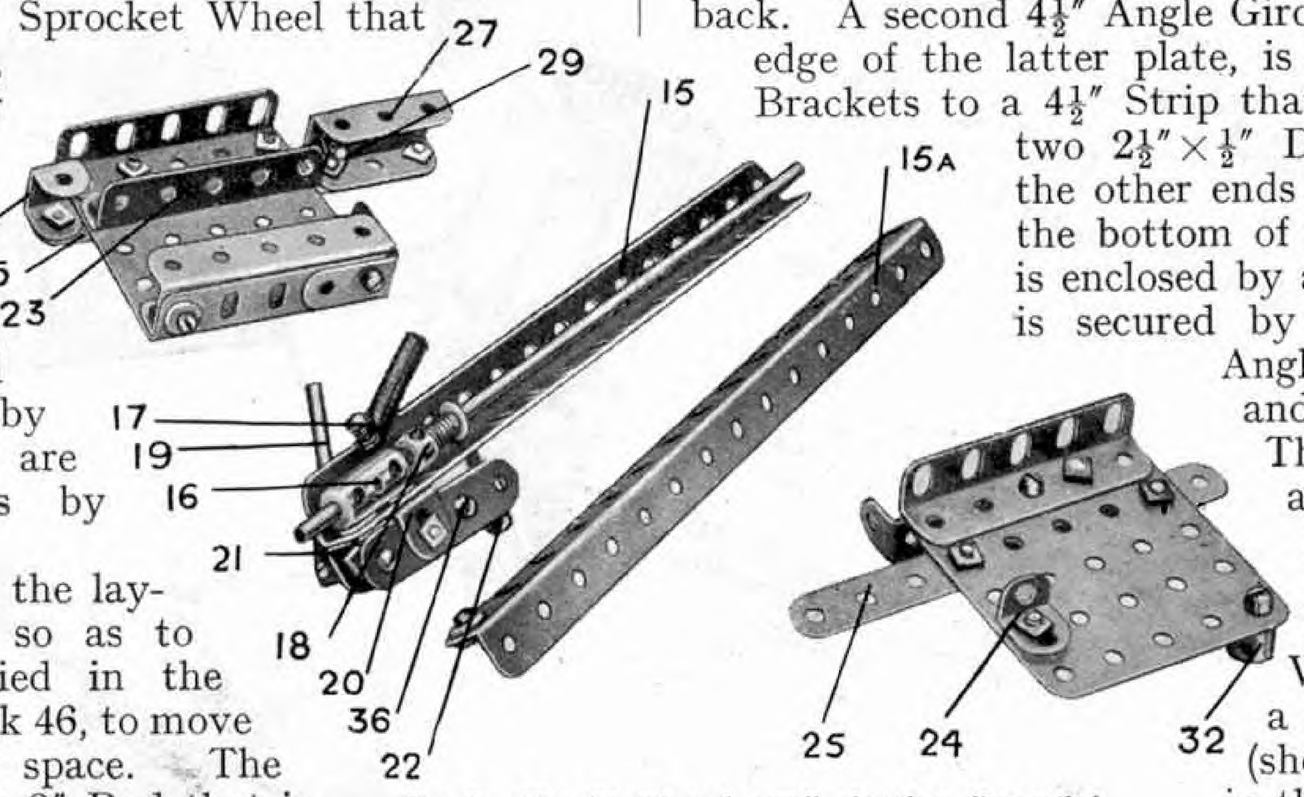


Fig. 6. The Barrel and recoil chamber dismantled. A Washer is shown in position ready for firing.

The road wheels are free to turn on an 8″ Rod 58. The Washers to be used in the gun are carried on ¾″ Bolts secured inside the limber.

The draw-bar (see Fig. 5) consists of a 5½″ Strip attached by a Flat Trunnion to two 1½″×½″ Double Angle Strips 59, one of which is secured to the base of the limber by the Bolts shown.

The gun, limber and tractor may now be assembled into travelling formation. The gun is coupled to the limber by raising the recoil spade 35 (Fig. 7) and passing the end hole of the Flat Trunnion over the Bolt 57 on the limber. The tractor is coupled to the limber by passing the two ⅜″ Bolts in the pivoted Strip of the draw-bar, through the ½″ Reversed Angle Brackets bolted to the Double Angle Strip 4 of the tractor.

The parts required to build the model are:—

HOWITZER; 2 of No. 2a; 2 of No. 4; 21 of No. 5; 2 of No. 6; 1 of No. 6a; 2 of No. 8b; 2 of No. 9; 2 of No. 9b; 6 of No. 9d; 4 of No. 9f; 3 of No 11; 15 of No. 12; 2 of No. 12a; 1 of No. 13a; 1 of No. 16a; 2 of No. 17; 3 of No. 18a; 2 of No. 19a; 2 of No. 22; 1 of No. 24; 62 of No. 37; 1 of No. 37a; 8 of No. 38; 1 of No. 43; 1 of No. 48a; 15 of No. 59; 2 of No. 62; 4 of No. 63; 3 of No. 64; 2 of No. 72; 2 of No. 77; 2 of No. 80a; 1 of No. 80b; 4 of No. 111; 2 of No. 111a; 4 of No. 111c; 1 of No. 115; 4 of No. 125; 1 of No. 126a; 2 of No. 136. LIMBER; 1 of No. 2; 1 of No. 2a; 1 of No. 5; 2 of No. 9a; 2 of No. 10; 10 of No. 12; 2 of No. 12a; 1 of No. 12b; 1 of No. 14; 2 of No. 19a; 5 of No. 35; 34 of No. 37; 9 of No. 37a; 4 of No. 38; 2 of No. 48; 2 of No. 48a; 3 of No. 53a; 2 of No. 59; 2 of No. 103f; 5 of No. 111; 1 of No. 111a; 1 of No. 126a. TRACTOR; 5 of No. 1b; 2 of No. 2; 4 of No. 3; 1 of No. 6; 2 of No. 8a; 4 of No. 9; 4 of No. 10; 5 of No. 11; 1 of No. 13a; 1 of No. 16; 2 of No. 16a; 6 of No. 17; 1 of No. 24; 2 of No. 25; 2 of No. 26; 2 of No. 27; 3 of No. 27a; 2 of No. 35; 69 of No. 37; 8 of No. 38; 4 of No. 48b; 1 of No. 52a; 5 of No. 53; 12 of No. 59; 2 of No. 62; 2 of No. 63; 4 of No. 70; 50″ of No. 94; 2 of No. 95; 1 of No. 96; 3 of No. 96a; 4 of No. 109; 4 of No. 111a; 1 of No. 111c; 1 of No. 115; 2 of No. 125; 2 of No. 126a; 1 Electric Motor.

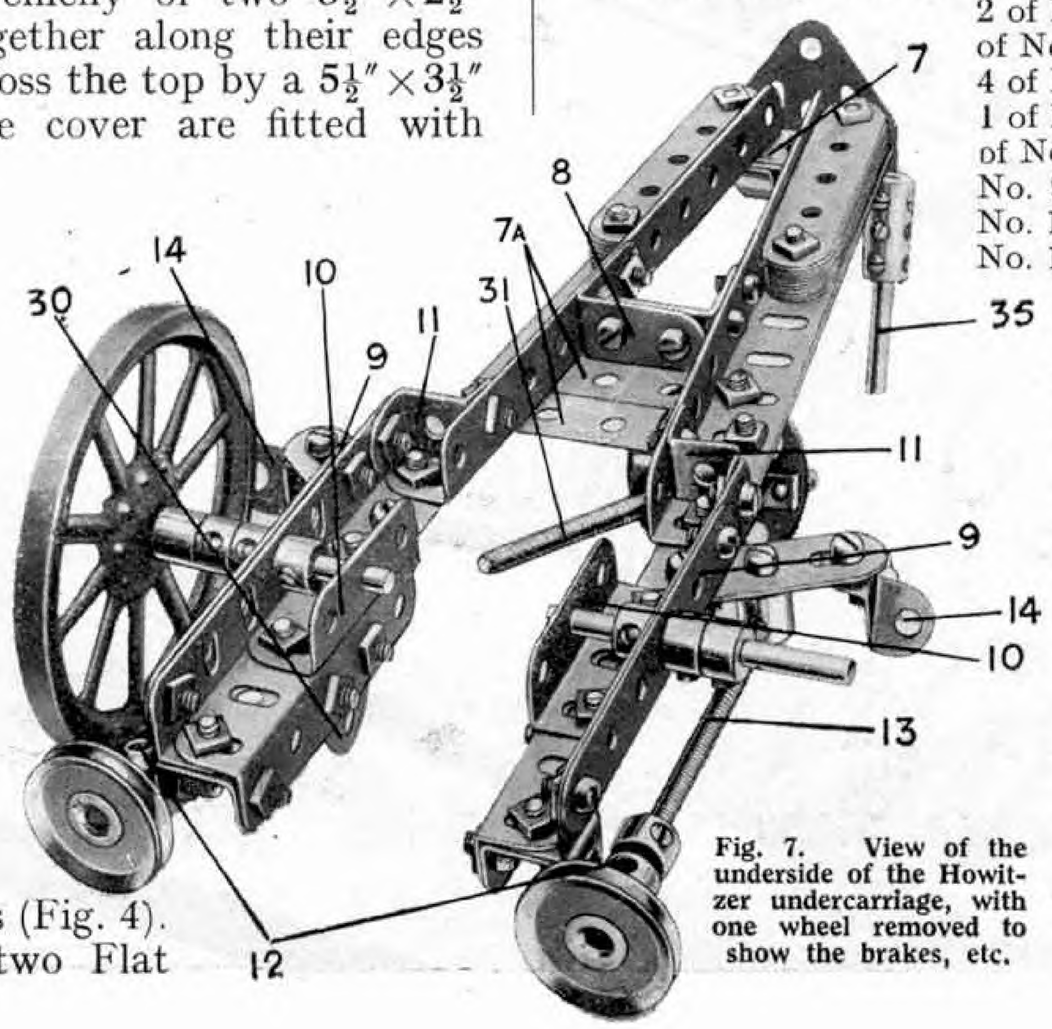


Fig. 7. View of the underside of the Howitzer undercarriage, with one wheel removed to show the brakes, etc.

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The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free.

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Australia: Price 2/- from dealers or 2/2 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K).

New Zealand: Price 1/- from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).

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MECCANO
The NEW BOOK OF NEW MODELS

Quebec Bridge

Suggestions Section "Spanner" Edited by

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(251) Intermittent Drive

(J. C. Cundle, Lancaster)

Automatic machines frequently require a mechanism that causes certain parts to operate intermittently instead of continuously. The most widely used form of intermittent drive is probably pawl and ratchet gearing, but several other types reproduced in Meccano have been dealt with in these pages. A simple method of obtaining an idle period for the driven shaft during every revolution of the driving shaft is to cut away a section of the driving gear. As the wheel rotates the teeth alternately engage and disengage the driven gear. In actual practice there would be a tendency for the teeth to be damaged, and the model illustrated in Fig. 251 shows an ingenious means of obviating this.

The driving shaft 1 carries a Bush Wheel to which two Rack Segments 2 are firmly secured. The Rod is extended beyond the Bush Wheel and a $1\frac{1}{2}''$ Strip is passed over the end and held in position by a Collar. The Strip is spaced from the Wheel by a washer to allow for the thickness of the Rack Segment 3, which is bolted to the end hole of the Strip. It will be seen that this Segment is free to swing, but it is normally held in the position shown, by a length of Spring Cord secured to the Bolt 4, and to the Bolt passed through the $1\frac{1}{2}''$ Strip.

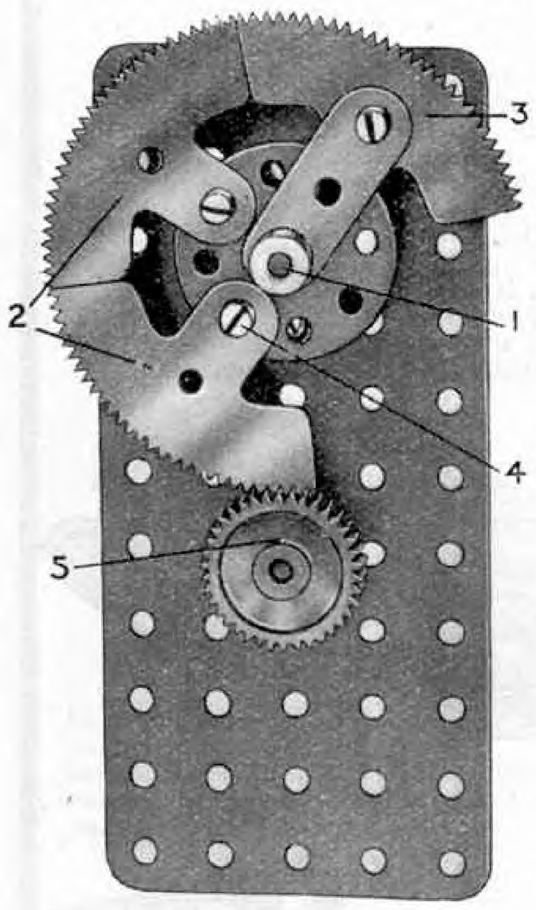


Fig. 251

When rotated in an anti-clockwise direction, the Segments 2 transmit a positive drive to the Gear 5, but as soon as the teeth of the Segment 3 engage the Gear it remains stationary, although the driving shaft continues to rotate. The Rack Segments 2 move round with the Rod and strike the Segment 3, which is forced to drive the Gear 5. The spring returns it to its former position.

(252) An Ingenious Quick-return Motion

(C. N. Marston, Halifax)

In actual practice a large number of machines incorporate some form of quick-return motion, and it is therefore not surprising that such a mechanism is frequently of use in Meccano model-building. In such cases an oscillating lever is generally employed, and an Eye Piece pivotally attached to a rotating wheel slides up and down the lever as it swings to and fro. The speed of movement of the lever depends upon the position of the Eye Piece in relation to the pivot. A novel variation of this device is shown in Fig. 252.

The driving shaft 1 is journalled in two $2\frac{1}{2}''$ Triangular Plates secured in the slotted holes of $2\frac{1}{2}''$ Angle Girders, which are spaced from the base plate by two Washers on each securing bolt. The bearings for the driven Rod 2 are formed by 2" Strips held in Trunnions. The two sets of bearings should be so arranged that the centres of the Rods are exactly $\frac{1}{2}''$ apart, and it is essential that the Rods should be in perfect alignment. Two Face Plates 3 are secured on the Rod 1 and spaced apart about $\frac{3}{8}''$, with the slots in each Plate directly opposite. The Face Plates 4 are mounted in a similar manner on the Rod 2, and a $1\frac{1}{2}''$ Rod 5 is passed through slots in each pair of wheels. The Rod carries five $\frac{1}{2}''$ loose Pulleys arranged as shown, and a Collar on each end holds it in position. The Face Plates should be spaced so that the Pulleys slide freely.

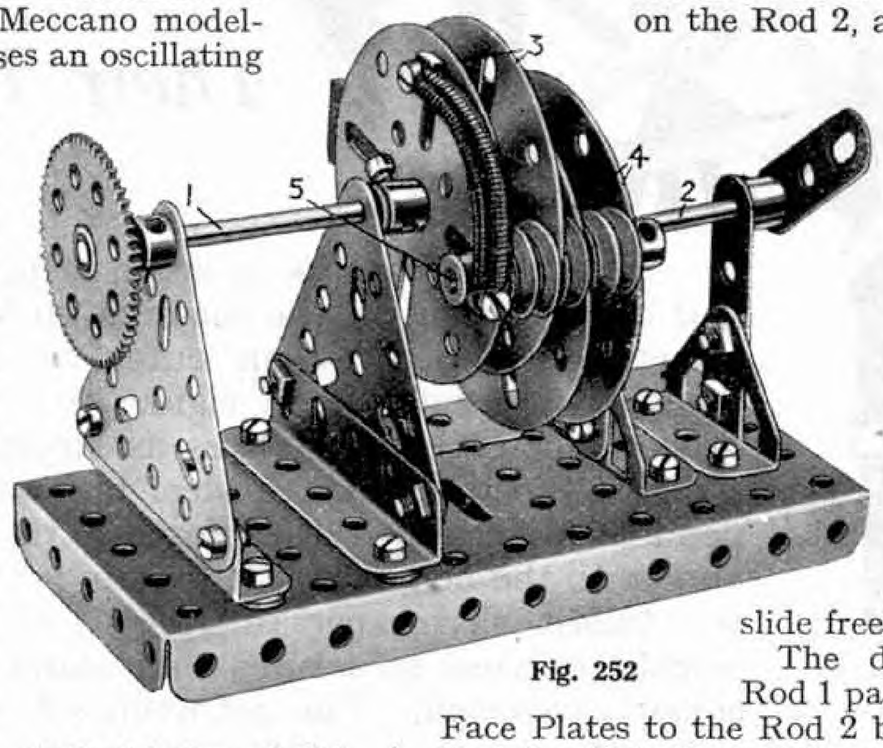


Fig. 252

The drive from the Rod 1 passes through the Face Plates to the Rod 2 by means of the Rod 5. This Rod slides up and down in the slots so that in its lowest position it is at the lower ends of the slots in the Face Plates 3, and at the upper ends of the slots in the Face Plates 4. Thus the Rod 2 rotates faster than the Rod 1, but as the Plates move round the increase in speed is gradually reduced, and in the opposite position the difference in the speed of the two Rods is reversed.

(253) A Curious Lever Movement

(W. R. White, Kansas City, U.S.A.)

It is well known that if a lever of the first order is pivoted at the centre, two equal weights will balance the arm when placed at equal distances from the fulcrum. On first examining the device shown in Fig. 253, this principle seems entirely wrong, as the mechanism is correctly balanced irrespective of the position of the two sliding weights. As shown the one weight is at the inner end of its arm and the other at the outer extremity, and yet the balance is maintained.

The vertical support for the levers consists of two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and to these two $3\frac{1}{2}''$ Strips are pivoted. Bolts passed through the centres of the Strips are each secured by two nuts to the support. The ends of the two levers so formed are pivotally linked together by $1\frac{1}{2}''$ Strips, and $2\frac{1}{2}''$ Strips are rigidly bolted to these to form "T" members. The sliding weights consist of Strip Couplings placed on the $2\frac{1}{2}''$ Strips.

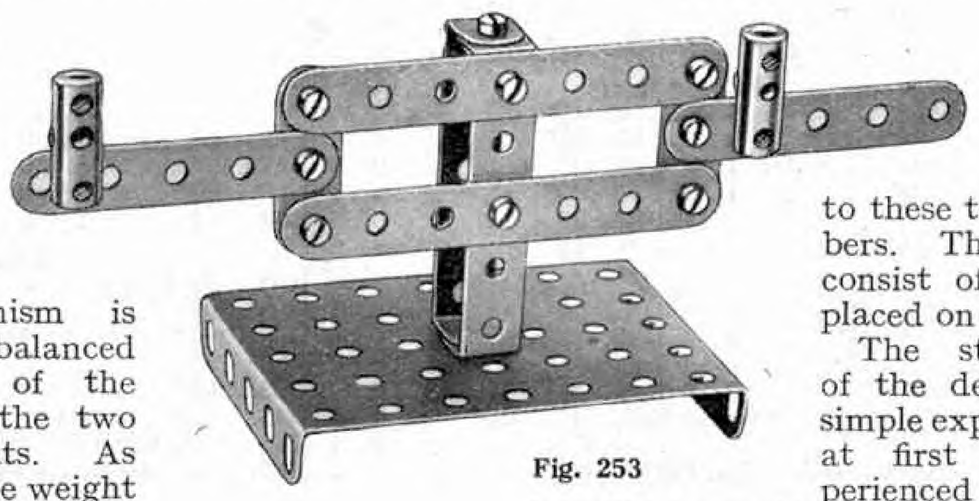
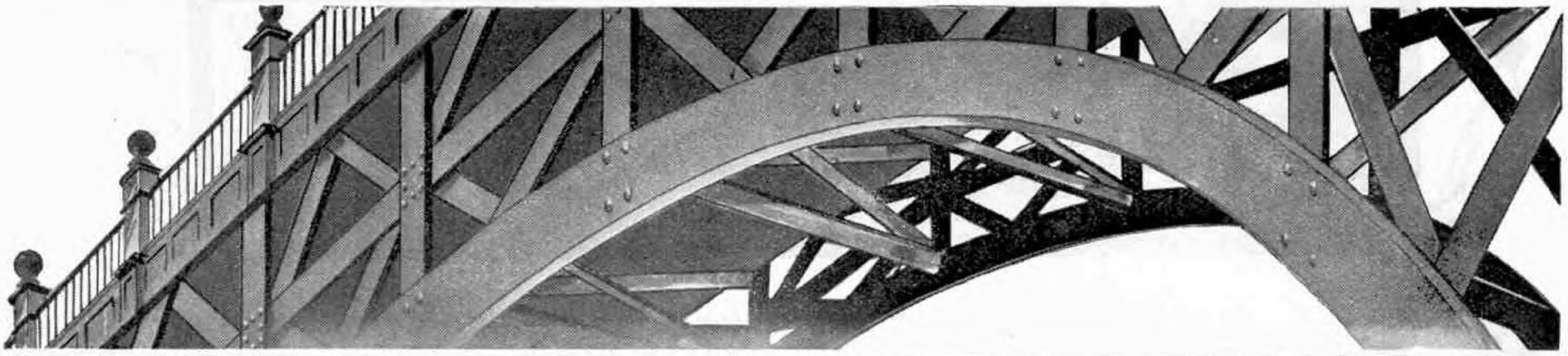
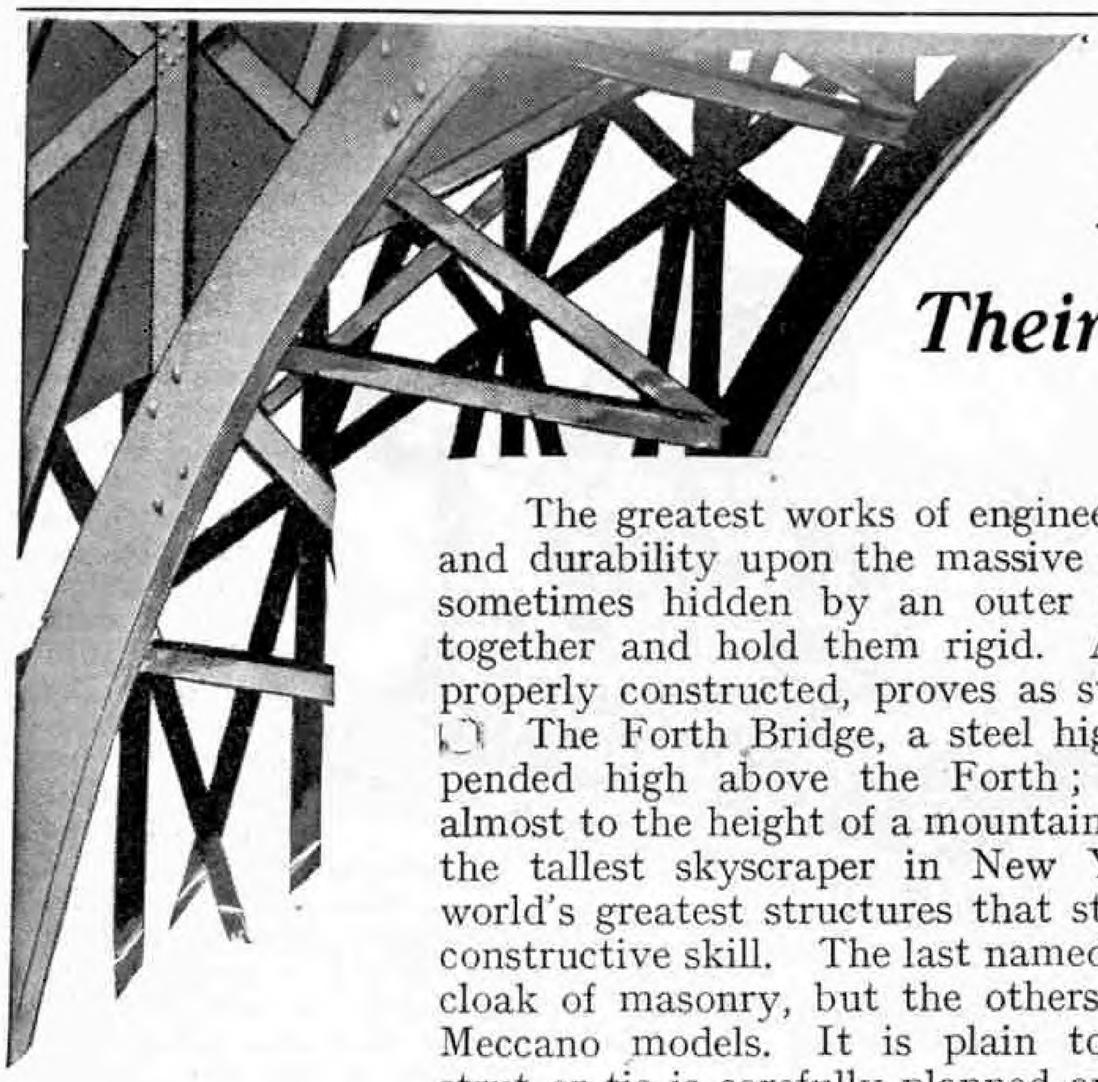


Fig. 253

The strange behaviour of the device has quite a simple explanation, although at first sight even experienced model-builders will be mystified. The "T" members are actually only weights, and do not form part of the levers as they are only pivoted to them. The positions of the Couplings do not matter, as the pivots of both "T" arms are at equal distances from the fulcrums.



MECCANO PARTS & ACCESSORIES



No. 1.—Girders

Their Importance in Engineering

The greatest works of engineering depend for their strength and durability upon the massive girders of steel which, though sometimes hidden by an outer casing of masonry, bind them together and hold them rigid. A single rolled steel girder, if properly constructed, proves as strong as a wall of masonry.

The Forth Bridge, a steel highway 1½ miles in length, suspended high above the Forth; the Eiffel Tower, extending almost to the height of a mountain; the Empire State Building, the tallest skyscraper in New York—these are three of the world's greatest structures that stand like monuments to man's constructive skill. The last named disguises its steel skeleton in a cloak of masonry, but the others tower into the sky like huge Meccano models. It is plain to see how even the smallest strut or tie is carefully planned and placed into position so that it may bear its allotted portion of strain or thrust.

Meccano Girders fulfil the same important duty in Meccano engineering. They are fitted into models and braced by Strips or Rods until the finished structure will support a man's weight, without the slightest disruption. Meccano Girders are made of the finest steel, and are beautifully enamelled in green. The edges and corners are rounded and smoothed off, while the perfect accuracy of their manufacture makes them invaluable in the construction of even the most intricate mechanisms. The following is a complete list of Meccano Girders and also of the different Meccano Strips, which may be used to form built-up girders.

Perforated Strips.

No.			s.	d.
1.	12½″	… ½ doz.	1	0
1a.	9½″	… „	0	9
1b.	7½″	… „	0	8
2.	5½″	… „	0	6
2a.	4½″	… „	0	5
3.	3½″	… ½ doz.	0	4
4.	3″	… „	0	3
5.	2½″	… „	0	3
6.	2″	… „	0	3
6a.	1½″	… „	0	3

Angle Girders.

7.	24½″	… each	0	8
7a.	18½″	… „	0	6
8.	12½″	… ½ doz.	1	9
8a.	9½″	… „	1	3
8b.	7½″	… „	1	2
9.	5½″	… „	1	0
9a.	4½″	… ½ doz.	0	10
9b.	3½″	… „	0	8
9c.	3″	… „	0	8
9d.	2½″	… „	0	7
9e.	2″	… „	0	6
9f.	1½″	… „	0	6

Double Angle Strips.

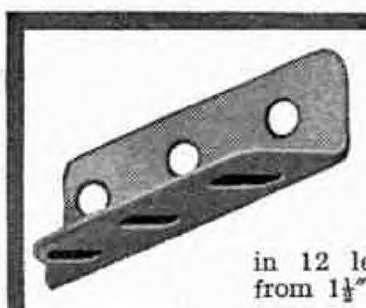
46.	2½″×1″	½ doz.	0	6
47.	2½″×1½″	„	0	9
47a.	3″ ×1½″	„	0	10
48.	1½″×½″	„	0	4
48a.	2½″×½″	½ doz.	0	5
48b.	3½″×½″	„	0	6
48c.	4½″×½″	„	0	9
48d.	5½″×½″	„	0	9
55.	Perforated Strips, slotted, 5½″	… each	0	2
55a.	„ „ „ 2″	… „	0	1
89.	5½″ Curved Strips, 10″ radius	… „	0	2
89a.	3″ Curved Strips, cranked, 1¾″ radius, 4 to circle	each	0	2
89b.	4″ „ „ cranked, 4½″ radius, 8 to circle,	„	0	2
90.	2½″ „ „ 2⅜″ radius	… „	0	1
90a.	2½″ „ „ cranked, 1⅜″ radius, 4 to circle	„	0	1

Braced Girders.

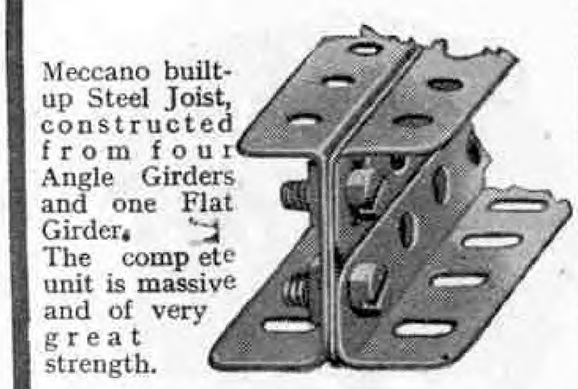
97.	3½″ long	½ doz.	0	9
97a.	3″ „	„	0	8
98.	2½″ „	„	0	8
99.	12½″ „	„	2	6
99a.	9½″ long	½ doz.	2	0
99b.	7½″ „	„	2	0
100.	5½″ „	„	1	0
100a.	4½″ „	„	0	10

Flat Girders.

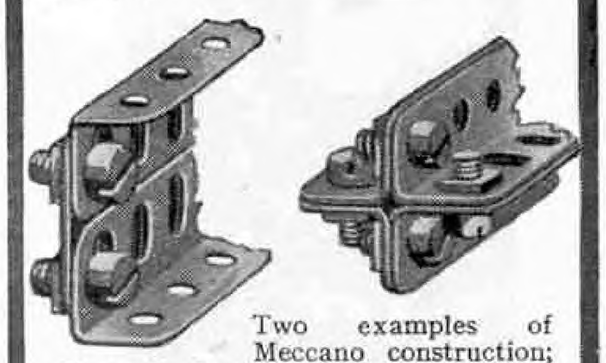
103.	5½″ long	½ doz.	0	10
103a.	9½″ „	„	1	2
103b.	12½″ „	„	1	3
103c.	4½″ „	„	0	9
103d.	3½″ „	„	0	7
103e.	3″ long	½ doz.	0	6
103f.	2½″ „	„	0	5
103g.	2″ „	„	0	4
103h.	1½″ „	„	0	4
103k.	7½″ „	„	1	0
113.	Girder Frames… … … … …	each	0	3
143.	Circular Girders, 5½″ diam. …	„	1	0
145.	Circular Strips, 7½″ diam. over all …	„	0	9



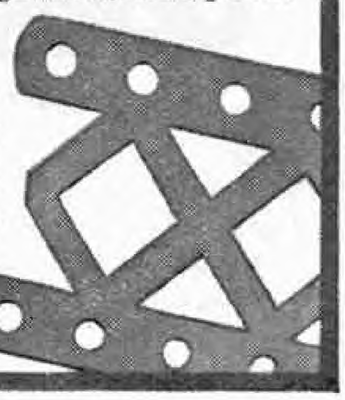
Angle Girders ("L" section, ½″ × ½″) in 12 lengths, ranging from 1½″ to 24½″.



Meccano built-up Steel Joist, constructed from four Angle Girders and one Flat Girder. The complete unit is massive and of very great strength.



Two examples of Meccano construction; Channel Section (left) and Cross Section Girders. The latter consists of a pair of "T" girders butted together.



Braced Girders. Stout lattice work throughout. Width 2″. In 8 lengths, 2½″ to 12½″. Very ornamental and of great utility.

YOUR DEALER WILL BE PLEASED TO SHOW YOU ALL THE MECCANO PARTS. ASK HIM FOR A COMPLETE PRICE LIST.

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In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

PROBLEMS AND IDEAS OF INTEREST TO ALL MODEL-BUILDERS

NEW CLOCKWORK POWER UNITS

The range of Meccano power units has been enlarged by the addition of two new and improved clockwork motors, known as the No. 1 and the No. 2 respectively.

The No. 1 Motor is a small unit of the non-reversing type, measuring only 3 in. by 4 in. by ¾ in. It is intended for use in models where compactness is essential, and it will be found particularly useful in small mobile models. It is provided with a brake lever, and an extended driving shaft to which gears and pinions may be secured, thus enabling the motor to be coupled to models. A novel feature of the motor is that the winding shaft is of such a size that it can be passed through a standard Meccano hole. This will be found very convenient in certain cases, as it enables the motor to be bolted beneath a plate, with the winding spindle projecting upward through the plate, so that the motor can be wound easily. This No. 1 Motor will run for approximately 1½ minutes when the driving shaft is unloaded, and it is capable of lifting 5 lb. through a distance of 12 in. when a 9 : 1 gear ratio is used.

Although this motor possesses remarkable power for its size, the best results can only be obtained from it when the gearing is carefully proportioned to the load. For driving many small models a gear ratio of 3 : 1 will be sufficient. This may be obtained by using a cord and pulley reduction system, consisting of a 1 in. Pulley on the driving shaft of the motor connected to a 3 in. Pulley on the driven shaft by means of an endless length of Meccano twine or Spring Cord. If Meccano spur gearing is to be employed, a ½ in. Pinion should be mounted on the driving shaft and meshed with a 57-teeth Gear Wheel secured on a shaft placed in the side-plate holes of the motor. Spur gearing, of course, gives an absolutely positive drive, and for this reason it provides somewhat better results than the cord and pulley systems. Pulley gearing is quite efficient, however, and even two sets of 3 : 1 gearing, giving a total reduction of 9 : 1, can be operated successfully.

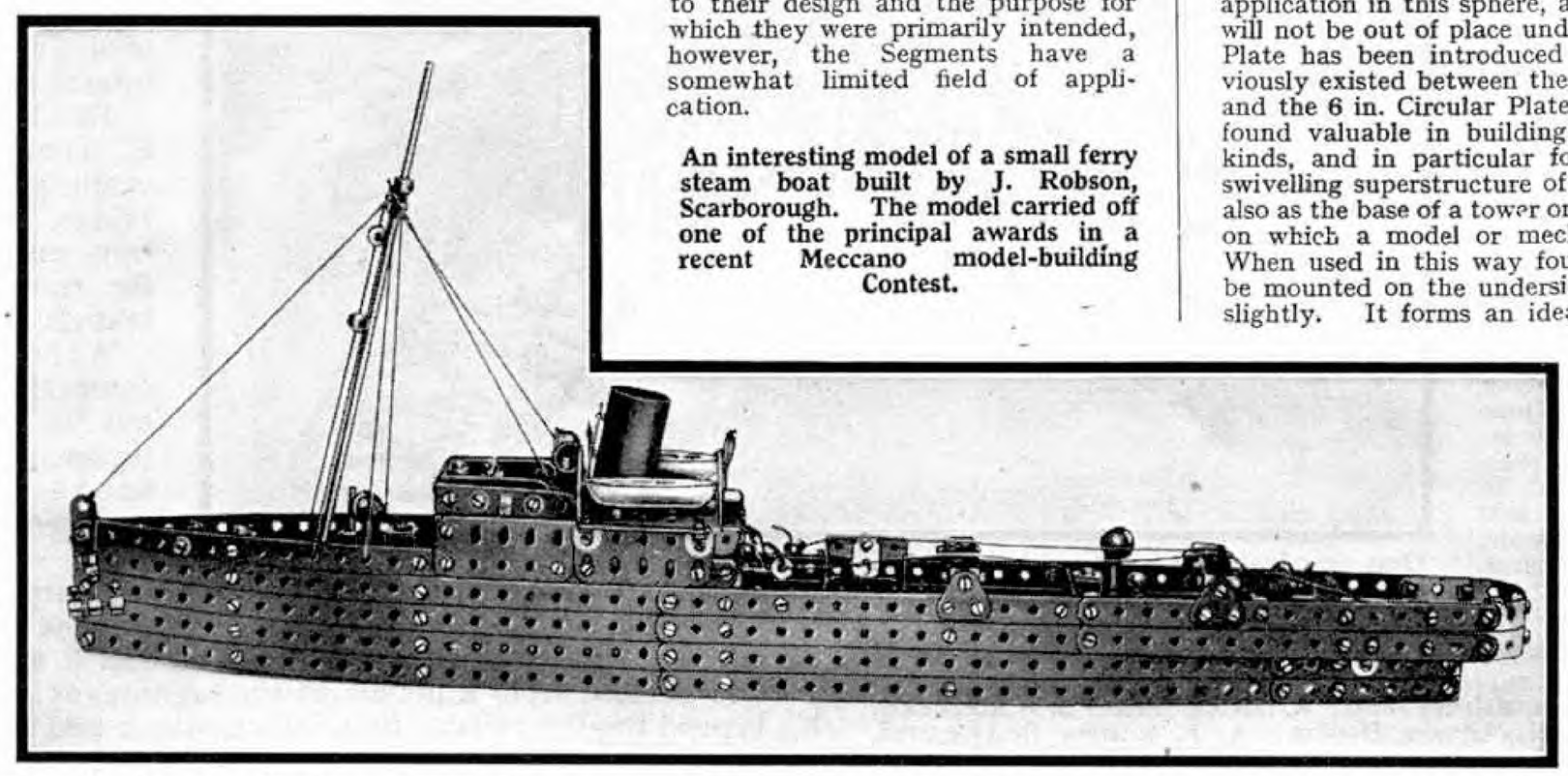
The No. 2 Motor measures 3½ in. by 4½ in. by ⅞ in., and is similar in general appearance to the original pattern Meccano Clockwork Motor. It is fitted with a much more powerful spring, however, and it represents a considerable advance over the original type, both in design and construction. The motor is provided with a brake lever and a reverse control, and it incorporates a standard extended axle-size shaft. It has a length of run of well over one minute, and it will lift a weight of 9 lb. through a distance of 7 in. on one winding when a 9 : 1 gear ratio is used.

This No. 2 Motor is intended for driving all types of Meccano models, including the largest and heaviest ones. It will be found ideal for operating large model buses and other mobile models, as it forms a self-contained unit of great power.

ADDITIONAL MECCANO STRUCTURAL PARTS

In addition to the new Meccano Grease Cups, Anchoring Springs, Coupling Hooks, and 2½ in. Gear, which we dealt with last month, several structural parts have also been introduced.

For some time past it has been realised that the range of Meccano curved members was incomplete, in that there were no curved parts that would enable an arch or circle to be made having a diameter of about 9 in. A circle of 7½ in. diam. was provided by the Meccano 7½ in. Circular Strip, part No. 145, but this was in many cases too small. On the other hand, the 5½ in. Curved Strips produced a circle, 20 in. in diameter, and while this is useful in very large models it is quite unsuitable for medium size models. The only parts that in any way approached the 9 in. circle were the Channel Segments, and when eight of these were bolted together a circle approximately 11½ in. in diameter was produced. Owing to their design and the purpose for which they were primarily intended, however, the Segments have a somewhat limited field of application.



An interesting model of a small ferry steam boat built by J. Robson, Scarborough. The model carried off one of the principal awards in a recent Meccano model-building Contest.

This state of affairs has now been rectified by the addition of the new 4 in. Curved Strip, part No. 89b. This Strip is designed so that when eight are bolted together a 9 in. diameter circle is produced, and the part is therefore known as a 4 in., 4½ in. radius Strip. The Strip incorporates the Meccano system of "cranking," so that when bolted together the Strips lie in the same plane. If the "cranking" were not undertaken the Strips would be out of line with each other, and an unsatisfactory form of construction would result.

One of the most important uses of the new Strip is of course in the construction of a 9 in. circle, which may be used as a flywheel for a model steam engine, etc. For the spokes of the wheel, 9½ in. Strips should be used, and a very satisfactory wheel can be constructed in this manner. In addition, the Strip will be found of great utility in building arches and all kinds of curved structures.

Model-builders who are interested in the construction of models on a small scale will often have felt the need for a small plate. To meet this need we have now introduced a 3 in. by 1½ in. Flat Plate, known as part No. 73. A wide range of uses can be found for this new part. One purpose that it serves admirably is that of a door in models where the 5½ in. by 3½ in. Flat Plates, or the 4½ in. by 2½ in. Plate, are too large. A Plate of the same size as part No. 73 can of course be built up from two Flat Girders, but the result is clumsy and not as satisfactory as when the 3 in. by 1½ in. Plate is used.

The Plate can be employed also in the construction of gear box frames, and in all kinds of mechanisms where compactness is essential. Another application for it is as a "fishplate" or jointing member for two large built-up girders.

Another new part that will be found very handy in structural work is the 1 in. Corner Bracket (part No. 133a). This part is designed for strengthening the corners of frameworks, and is particularly useful in building bridges and crane booms where Angle Girders have to be locked in position very firmly. This new part closely resembles the corner plates actually used in engineering for this purpose.

The new 4 in. diameter Circular Plate, part No. 146a, while not being entirely a structural part, has a wide application in this sphere, and a few notes on its uses will not be out of place under this heading. The new Plate has been introduced to fill the gap that previously existed between the 3 in. diameter Face Plate and the 6 in. Circular Plate. The 4 in. Plate will be found valuable in building circular structures of all kinds, and in particular for use as the base of the swivelling superstructure of a crane. It may be used also as the base of a tower or as an ornamental pedestal on which a model or mechanism may be mounted. When used in this way four Handrail Supports may be mounted on the underside of the Plate to raise it slightly. It forms an ideal Face Plate for a model lathe, in which case a Bush Wheel should be secured to its centre. The boss of the Bush Wheel should be pushed through the large centre hole in the Plate, and the Bush Wheel then bolted to the face of the Plate by means of four bolts. It will be seen that the slots in the face of the part make the centring of a piece of work on the lathe face plate a particularly simple matter.

Other functions of the part are as a flywheel—several of the Plates can be bolted together to provide a particularly heavy member—and as a locomotive driving wheel.

A USEFUL COUPLING UNIT

Constructors who are experimentally inclined will be interested in the new Meccano Flexible Coupling Unit, part No. 175. This part consists of lengths of special spring material, the ends of which are solid. The external diameter of the spring is such that it will pass through a standard Meccano bore, and the ends of the unit can thus be mounted in any standard parts such as Couplings, Bush Wheels, etc. The part provides a flexible spring coupling between two rotating shafts that are not in the same straight line, and it thus fulfils the function to some extent of a universal coupling. It provides much greater angularity of drive than is possible with a standard universal joint, however. To couple two shafts together by means of the part it is merely necessary to mount a Coupling on the end of each shaft and grip the solid ends of the Coupling Unit in the bores of the Coupling. The unit will be found handy in coupling up a Motor to a model, and in the construction of angular drives such as the propeller shaft of a model boat.

The best suggestion for a new or improved Meccano part sent in during the month of September, was submitted by H. W. North, Coventry, and the monthly prize of 10/- has therefore been awarded to him. The winning idea was for an improvement to the Meccano Bobbin, electrical part No. 301.

SPECIAL CABLE.—Your suggestion that Bowden type cable should be introduced into the Meccano system is interesting, and this would be useful in the construction of controlling devices of all kinds. You will be interested to hear that a cable of this kind can be improvised from standard Meccano parts. The cable consists of a length of Bare Iron Wire, part No. 31 encased in a sheathing consisting of Meccano Spring Cord. The Cord is held in position at the correc tension by means of set-screws in the bores of the Couplings, etc., and the ends of the length of Iron Wire are attached to the control levers. This cable will be found excellent for operating the brakes and other controls of model motor cycles and push cycles. It is almost identical with the system employed in actual practice. Special manufactured cable is consequently unnecessary. (*Reply to L. James, Cinderford*).

Results of Meccano Model-Building Contests

By Frank Hornby

"Bridge" Competition (Home and Overseas Sections)

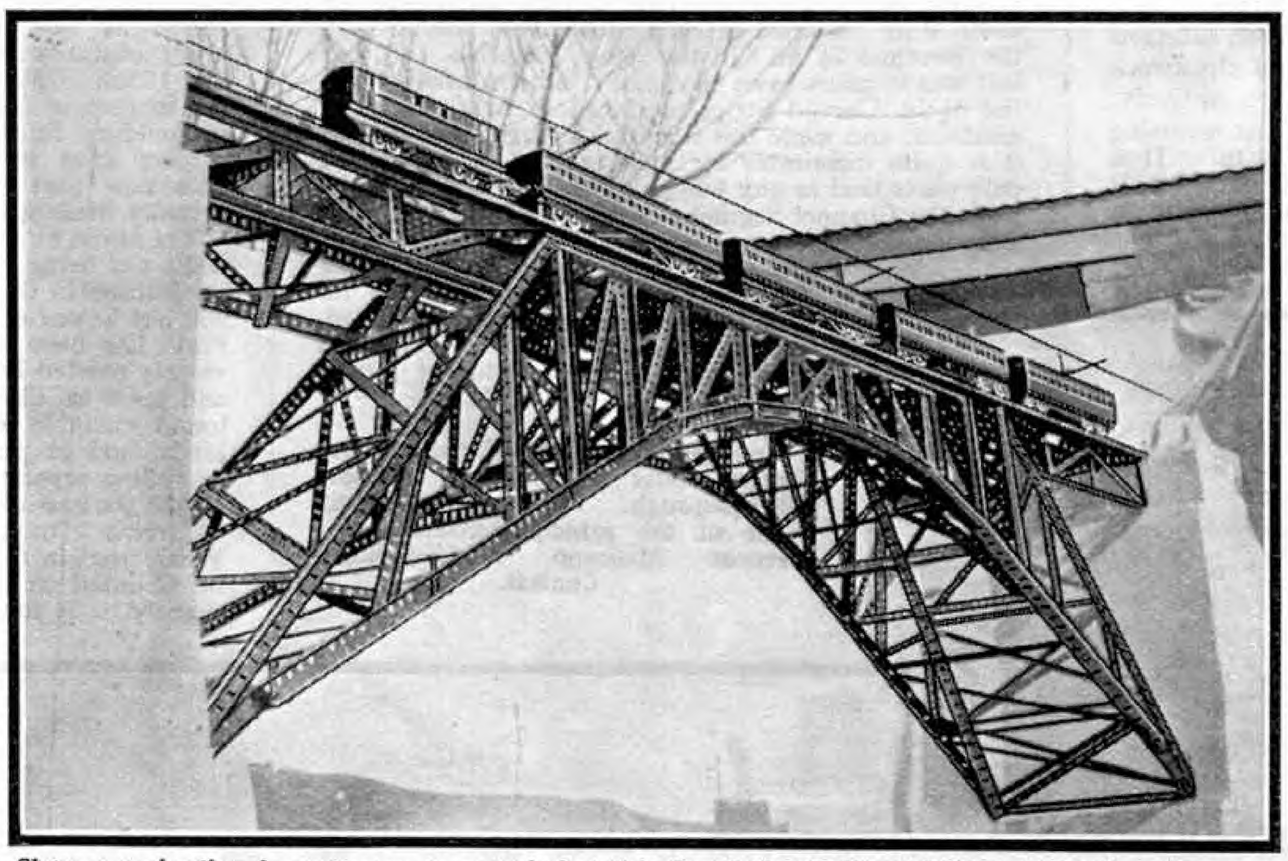
AFTER careful consideration the judges of the "Bridge" Model-building Contest decided to award the prizes to the competitors named in the following lists:

Home Section.

FIRST PRIZE (tie, each competitor to receive cheque for £1-11s.-6d.): J. H. Sheldon, Smethwick, Staffs.; L. Hollyoak, Earlsdon, Coventry. SECOND PRIZE, Meccano goods value £2-2s.: L. Blowers, Plumstead, London, S.E.18. THIRD PRIZE, Meccano goods value £1-1s.: D. McLean, Moss Side, Manchester.

TEN PRIZES, Meccano goods value 10/6: W. E. Hunt, Ealing, London, W.5; A. H. Smith and R. H. James (joint award), Sheffield; T. Clark, Strabane, Co. Tyrone; E. J. Bottle, Worthing; C. Clarke, Bristol; J. Stebbings, Kingsbridge, Devon; W. B. Williams, Blandford, Dorset; W. E. Cavanagh, Offaly, Ireland; F. W. Hole, Taunton; F. Scales, Wisbech.

TEN PRIZES, Complete Bound Manuals: G. K. Holland, Liverpool: E. S. Smith, Rock Ferry, Cheshire; J. A. Willman, Dumfries; T. Pearson, Littlestone; W. G. Wright, Oxton, Birkenhead; L. Leeson, Brigg; G. D. Ingham, Wath-on-Dearne, near Rotherham; R. Lunn, Barnby Dun, near Doncaster; D. Walker, Wilmslow, Cheshire; L. A. Frayn, Plymouth.



Close examination is necessary to reveal hat this fine Swiss Railway Bridge really is a Meccano model! It won First Prize for A. Robert, Johannesburg, in the Overseas Section of the "Bridge" Competition.

TEN PRIZES of "*Famous Trains*" by C. J. Allen: A. J. Stacey, Reading; W. F. Clement, Willington, Durham; C. Lancaster, Lytham; L. Halstead, Trawden Forest, near Colne; R. Allen, Malvern Wells; R. Barton, Leeds; S. Wotherspoon, Waterloo, Liverpool; C. N. Marston, Halifax; A. F. Ruston, Berkhamsted, Herts.; G. Rowland, Rickinghall.

Overseas Section.

FIRST PRIZE, Cheque for £3-3s.: A. Robert, Johannesburg, S. Africa. SECOND PRIZE, Meccano goods value £2-2s.: V. Stewart, Lefroy, Ontario, Canada. THIRD PRIZE, Meccano goods value £1-1s.: P. Tombeux, Courtrai, Belgium.

TEN PRIZES, Meccano goods value 10/6: G. Humm, Geraldine, New Zealand; R. Himburg, Dunedin, New Zealand; M. Wood, Johannesburg, S. Africa; J. Driver, Palmerston North, New Zealand; N. S. Variaver, Bombay, India; C. Ralling, Cape Town, S. Africa; K. Lewis, St. John's, Newfoundland; R. J. Andrews, Muizenberg, Cape Colony, S.A.; G. Dodds, Stratford, Ont., Canada; Jan de Waal Malefjt, Arnhem, Holland.

TEN PRIZES, of Bound Manuals: L. Cjhyssaert, Courtrai, Belgium; D. Hill, Takaka, New Zealand; W. L. Barry, Christchurch, New Zealand; W. Wadley, Johannesburg, S. Africa; A. Brighton, Sydney, Australia; N. Golightly, Vancouver, Canada; A. Hawley, Antwerp; O. Gosling, Rio de Janeiro; D. Davies, Cape Town, S. Africa.

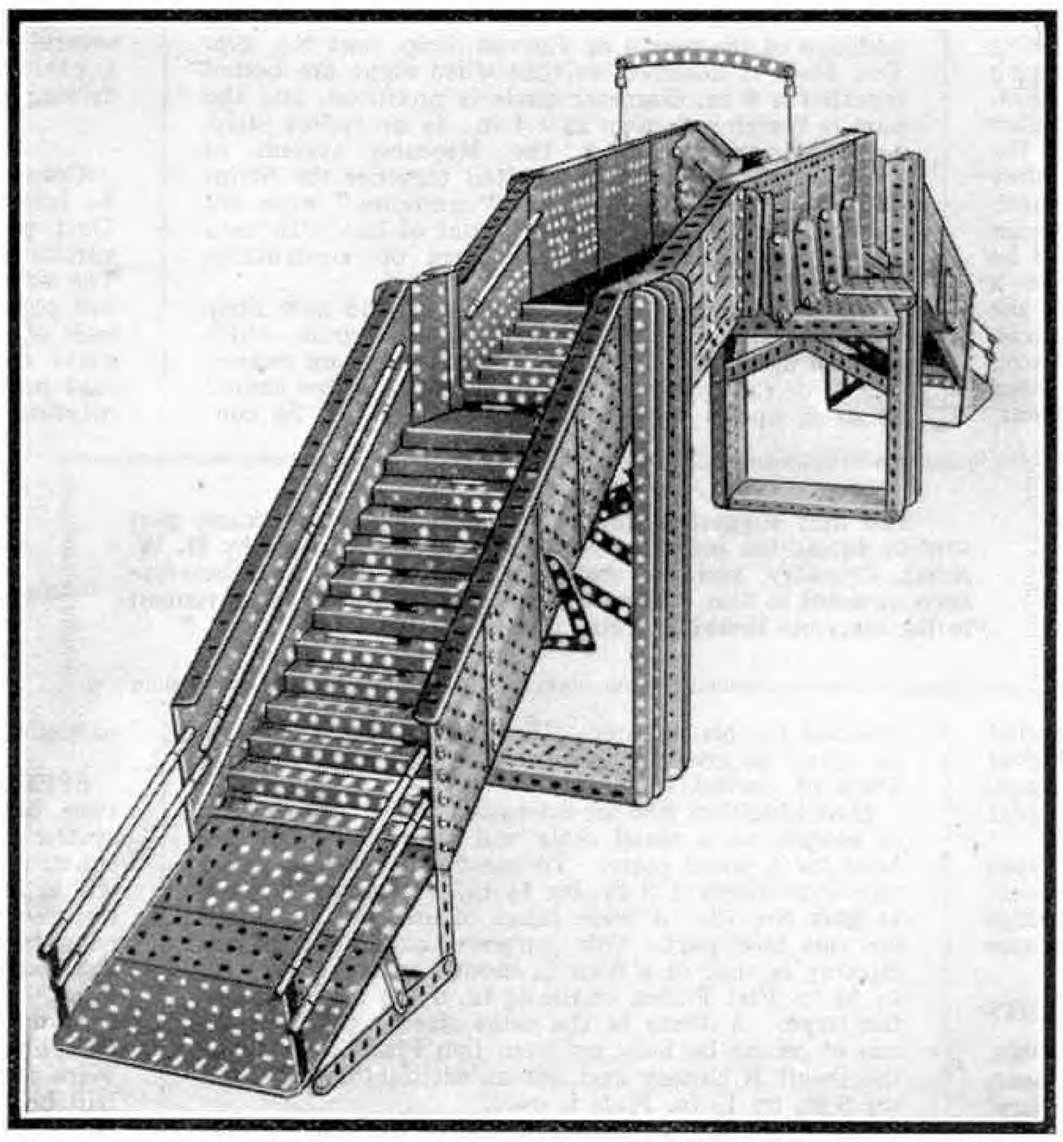
A number of CERTIFICATES OF MERIT have also been awarded in each Section.

In the Overseas Section First Prize was won by A. Robert, of Johannesburg, who built the splendid model of a Swiss railway bridge illustrated on this page. Readers should note particularly the fine construction of the arch, and the neat and practical manner in which the various ties and struts are arranged. Over 1,200 nuts and bolts have been used in building the model, which is over 6 ft. in length. When completed the model was put under test and was found to be capable of supporting easily the weight of three men! The model is copied from an actual railway bridge in Switzerland.

Second Prize in this Section was awarded for a model of the Quebec Bridge, built by a Canadian competitor, V. Stewart. Unfortunately the photograph submitted is too small for reproduction otherwise the model would have made an interesting illustration.

Third Prize was won by P. Tombeux with a good example of a transporter bridge, which he copied from an actual bridge used for transporting goods at Matadi, Belgian Congo.

While the majority of competitors based their models on world-famous bridges, one or two of the finest models submitted represented more humble types of bridges such as ordinary railway and road bridges. The amount of realism attained in some of these models is truly remarkable, as will be seen from a glance at the accompanying illustration of a typical English railway foot-bridge, which tied for First Prize in the Home Section. It was built by Leslie Hollyoak of Coventry, and is a faithful reproduction of a bridge over the L.M.S. Railway at Canley Gates, near Coventry.



Realism was the chief aim of Leslie Hollyoak, Coventry, in building this fine model of an English railway foot-bridge. The model tied for First Prize in the Home Section.

The model is about 6 ft. in length and is so soundly constructed that it will easily support its builder, who weighs nearly 10 stone. This is a satisfying testimonial to the strength of the Meccano parts when properly used and correctly bolted together. At every joint in the roadway there are three complete rows of nuts and bolts; a total of over 500 nuts and bolts are used throughout the complete structure.

A touch of realism is given by the bar over the centre of the bridge, from which a lamp may be hung at night time. Careful examination of the illustration will reveal "spikes" (bolts) placed on the sides of the bridge to prevent adventurous children climbing on to the bridge sides. Note also the smoke pans placed over the railway tracks to deflect the smoke from passing locomotives and so prevent the bridge being blackened.

The other First Prize model in the Home Section is a copy of the Montreal Bridge, which was opened for traffic on 24th May, 1930. This

(*Continued on page 938*)

"Collis Truck" Contest

Overseas Section Results

THE results in the Home Sections of the "Collis Truck" Competition were announced last month, and this month we have pleasure in publishing the list of prize-winners in the Overseas Section. The standard of work done by competitors abroad compares favourably with that of Home competitors.

First Prize has gone to South Africa, Second Prize to Holland and the Third Prize to New Zealand. India is represented among the smaller prize-winners.

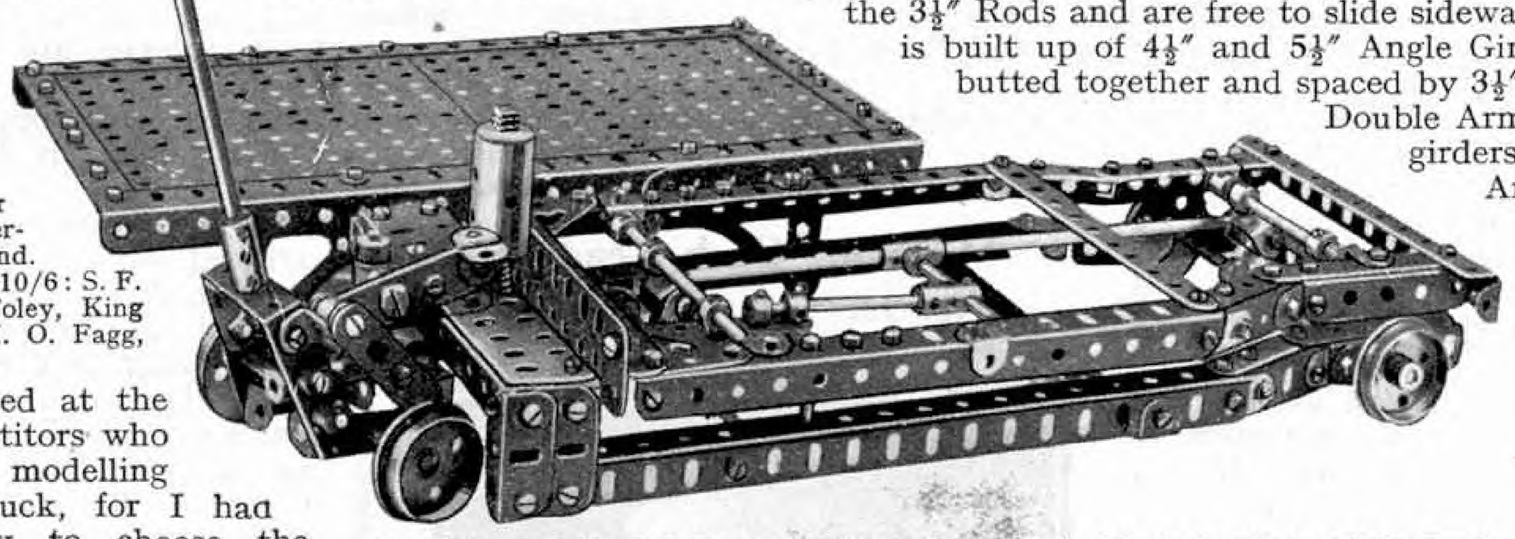
The principal awards in the Contest are as follows :—

FIRST PRIZE, cheque for £3-3s.: J. J. Pienaar, Johannesburg, S. Africa.

SECOND PRIZE, cheque for £2-2s.: J. Ringnalda, Leeuwarden, Holland.

THIRD PRIZE, cheque for £1-1s.: R. H. Stokes, Henderson, Auckland, New Zealand.

Three Prizes of cheques for 10/6: S. F. Desai, Navsari, India; J. Foley, King Williamstown, S. Africa; H. O. Fagg, Milton, Otago, New Zealand.



First Prize model by J. J. Pienaar, (Johannesburg, S.A.), of the hydraulic type Collis Truck.

I was rather surprised at the large number of competitors who went to the trouble of modelling the hydraulic type truck, for I had expected the majority to choose the mechanical truck owing to the difficulty of reproducing the hydraulic mechanism. Competitors seem to have found the task fairly easy, however, and some really excellent models were submitted. The best model of this type is that which won First Prize for J. J. Pienaar, South Africa. The model, together with the lifting platform, is shown here. The utmost that I can say in praise of this fine model is to advise readers to compare the illustration on this page with the illustration of the actual truck on page 137 of the "*M.M.*" for February 1931.

The load is lifted by a few up-and-down strokes of the steering handle, which operates a link and rod motion, and draws the lifting frame forward and upward. The effective lifting height of the frame is $\frac{3}{4}$ in., and when fully raised it is locked in position by an Angle Bracket that engages between the two Collars to be seen near the lower end of the steering handle.

A model that displays evidence of considerable care and patience in construction is the Second Prize entry of J. Ringnalda. It is illustrated here, and it will be seen that it represents one of the mechanical pattern trucks. The model possesses a load check release in which Sleeve Pieces serve as the hydraulic cylinder of the actual machine, and a $\frac{1}{2}$" Pulley for the piston. A novel idea is the use of Sprocket Chain to provide a ribbed surface for the foot-operated pedal that is used to release the load platform from its raised position.

The wheels of the actual truck have a wide flat rim and to reproduce these, Ringnalda uses three Wheel Flanges bolted to Bush Wheels. The Bush Wheels are secured to the Rod so that the three Wheel Flanges form one complete wheel.

R. H. Stokes, New Zealand, earned his prize with a model of the hydraulic truck. Unfortunately the only photograph I have is unsuitable for illustration purposes. The lifting frame is fastened to the main frame by four $1\frac{1}{2}$" Strips in the same way as in the prototype, and the toggle yoke also is exactly the same as on the real truck.

The hydraulic cylinder is represented by a Coupling in which slides a 2" Rod fastened to the lifting frame. The two central wheels are $1\frac{1}{2}$" Pulleys, and those at the back and front are each made of two Bush Wheels bolted together. The $1\frac{1}{2}$" Pulleys are slightly larger in diameter than the Bush Wheels, and this gives the necessary rock and applies the load to the centre wheels thus facilitating steering. The clutch pedal is a two-arm Crank, in the set-screw hole of which is a $\frac{1}{2}$" Bolt. When the pedal is depressed, the Bolt pushes against an Angle Bracket and releases the lifting frame from its raised position.

Among the smaller prize models the best entry is that submitted by J. Foley. In this case the lifting frame is supported by four links, which are capable of being pulled forward by a downward movement of the lifting handle. The links are represented by Cranks pivoting on Rods secured in Double Arm Cranks bolted to the sides of the lifting frame.

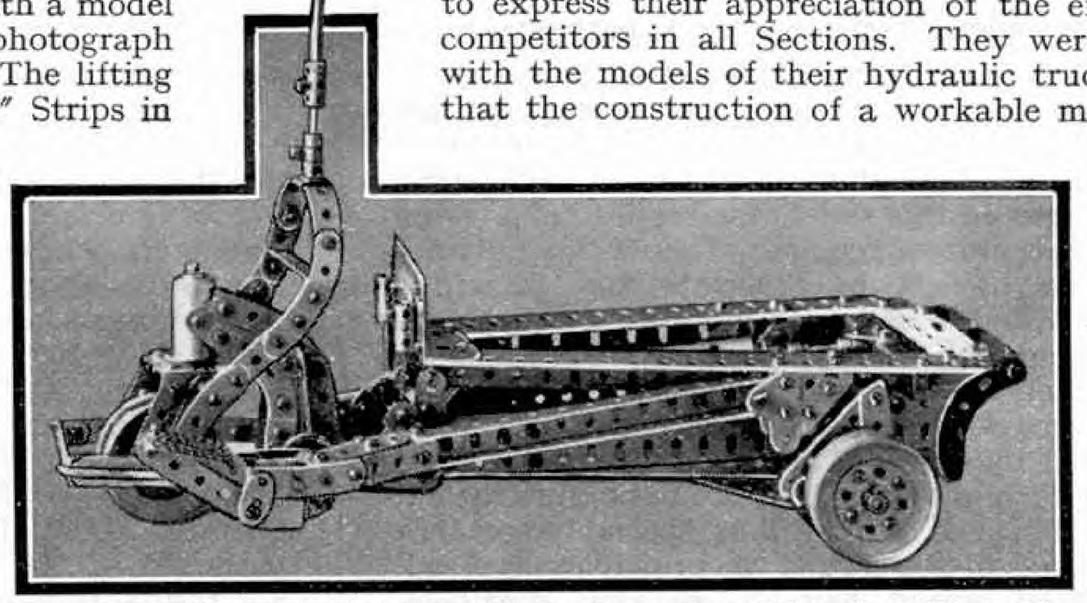
The side members of the chassis are $9\frac{1}{2}$" Angle Girders connected by $3\frac{1}{2}$" Axle Rods and $3\frac{1}{2}$" Double Angle Strips. The chassis is mounted on $1\frac{1}{8}$" Flanged Wheels that rotate freely on the $3\frac{1}{2}$" Rods and are free to slide sideways. The lifting frame is built up of $4\frac{1}{2}$" and $5\frac{1}{2}$" Angle Girders. These are end-butted together and spaced by $3\frac{1}{2}$" Axle Rods secured in Double Arm Cranks bolted to the girders, and also by a $5\frac{1}{2}$" Angle Girder, on which an Eye Piece engages to form a safety catch. The Eye Piece is moved by a lever placed near the lifting handle, and is utilised to lock the lifting frame in position when raised. The frame is prevented from moving too far forward by bolts secured to the lifting links in such a position that they engage with two Corner Brackets bolted to the front end of the Chassis. A Tension Spring prevents the frame from descending too rapidly. The load platform is built up of two $7\frac{1}{2}$" Flat Girders bolted to two $5\frac{1}{2}$" Double Angle Strips, the space between being filled with Flat Plates.

S. F. Desai, India, submitted two models, one of which represented the hydraulic truck and the other the mechanical truck. Both models are excellently constructed. The model of the mechanical truck is constructed as simply as possible, but all the movements of the original are reproduced with remarkable accuracy, considering the limited amount of space available.

The hydraulic truck model constructed by Desai embodies several interesting features, the most outstanding of which is a ratchet and pawl mechanism, which is used in place of the hydraulic action in the original. The mechanism is controlled from a small lever situated in a convenient position on the truck handle, and the pawls are operated simply by working the lifting frame handle upward and downward. It is interesting to note that this model is constructed on similar lines to the model that won Second Prize in the Home Section for V. C. Kaile.

H. Fagg won his prize with a model of the "R" type truck, in which he has skilfully incorporated all the movements of the prototype. This model is one of the neatest entered in the Contest, although in point of construction it falls slightly below the standard attained by the chief prize-winners.

J. Collis & Sons Ltd., the sponsors of this Contest, wish me to express their appreciation of the excellent work done by competitors in all Sections. They were exceptionally pleased with the models of their hydraulic trucks, for they are aware that the construction of a workable model of this type is by no means an easy task. They wish to thank all competitors at Home or Overseas who took part in this Contest whether prize-winners or not, for collectively they have made the "Collis Truck" Competition one of the most interesting and successful that have yet been organised.



This model of the mechanical type Collis Truck won Second Prize for J. Ringnalda, Leeuwarden, Holland.



Helping the Club Secretary

I have been looking over the reports I have received from Meccano Clubs since the commencement of the present session and have been greatly impressed by the improvement in organising powers that they reveal. Order and forethought are the two chief aids to success in running a club, and these are more in evidence every year.

The idea behind the organisation of most successful clubs appears to be a suitable division of labour. The purpose of this is not to create a large number of officials, but to ensure that each of the many duties necessary is carried out most efficiently. Apart from the Leader, the hardest-worked official of a club undoubtedly is the secretary, whose duties become more onerous as his club becomes more successful. In many cases an assistant is appointed to share the general work of the office. This is an excellent plan, but it is probably more satisfactory to nominate members to carry out special duties that usually fall to the lot of the secretary. For instance, many clubs have adopted a plan that I have previously suggested in these pages, and have appointed a special report secretary whose chief duty is to keep Headquarters in touch with progress.

A further step that may well be taken is that of electing an exhibition secretary, who is responsible for exhibitions, concerts and special meetings arranged for the purpose of giving the outside public an idea of the work carried on in the club. An exhibition secretary specialises in his work, thinks about his task continually, and is always eager to hear of new ideas that will be of service to him and to his club. The credit of a successful exhibition is largely his, of course. It is also quite certain that he will be blamed for any fiasco! For this reason he is generally keen to enlist the support of other members, and takes the necessary steps to ensure their active co-operation. In so doing, he not only relieves the secretary of a heavy part of his duties, but is able to carry out the work more efficiently.

Meccano Club Leaders

No. 55. Mr. J. D. Story



Mr. J. D. Story is Leader of the Whitley Bay M.C. This was founded by Mr. Story in October, 1930, and secured affiliation last March. All connected with the club are full of enthusiasm, and an attractive programme has been arranged.

Suggestions for Model-Building Contests

I am often asked for advice on the arrangement of a programme of model-building competitions. For this purpose excellent use could be made of the series of "*Secrets of Engineering*" that have appeared recently in the "*M.M.*" Many questions of engineering interest have been answered in this series, the replies being given briefly and in simple but accurate language. There is no difficulty in constructing Meccano models to illustrate the principles involved, and a very attractive series of monthly competitions could be arranged by taking each "secret" in turn. For instance, in the first contest of such a series, members may be asked to design suitable mechanisms for illustrating the use of flywheels, and this could be followed by others in which models of standard link motions, or of various types of gear box, are to be constructed. In judging models entered in such competitions, special importance should be attached to success in illustrating the principles involved. Competitions of this kind would help to develop members' resources and engineering knowledge.

For Overseas Readers

Overseas clubs are showing excellent progress. This is particularly noticeable in New Zealand, where a number of new clubs have been formed, some of which have already secured affiliation. Similar reports come from Australia and South Africa, where satisfactory increases are noticeable, both in the number of clubs and in their membership. In all these countries keen Meccano boys have excellent opportunities of enjoying their hobby in the company of other enthusiasts.

A very interesting feature is the increased interest in Guild work shown in Canada. Strong clubs have been formed in British Columbia and Saskatchewan, and efforts are being made to establish similar organisations in other parts of Canada. I hope that these will be successful, and that Meccano boys in Canada will make every effort to bring their country into line with others overseas in which the Guild and club movement has firmly established itself.

Last month I referred to the combined leaflet and application form that is now being used. This form also is available for those living overseas who wish to obtain information about the Guild and to make application for membership. Meccano boys and others interested in the hobby who live in Canada, Australia, New Zealand, or South Africa may obtain copies from our agents in those countries, who will forward badges and certificates to applicants who send in their application forms accompanied by a remittance of 1/– to pay for the badge. This plan has been arranged in order to save time. The signed application forms are forwarded to Headquarters at Liverpool, in order that the new members may be duly enrolled, and I wish to emphasise the fact that members joining the Guild through the agents of Meccano Ltd. overseas are in exactly the same position as those who send their forms to Headquarters. Those who do not object to the delay may obtain their badges and certificates direct from Headquarters if they wish, and the full privileges of membership, including that of direct communication with the President and Secretary, are available to all.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below:—

ASHTON-IN-MAKERFIELD—J. Fisher, 20, Gerard Street.
HARLESDEN—L. Rallison, 6, Harley Villas, Harley Road, Harlesden, N.W.10.
HARROGATE—C. Crausaz, 30, Lowther Arcade.
HIGH WYCOMBE—E. H. Weaver, 73, Queen's Road.
LANARK—F. C. Brown, 23, High Street.
LIVERPOOL—H. Newell, 26, Karslake Road, Wavertree.
LONDON—D. J. Lewer, 92, Gore Road, South Hackney, E.9.
RETFORD—P. H. Sutton, "Iedale," Whitehouses.
SOUTHBOROUGH—G. Featherstone, 94, London Road, Southborough, Nr. Tunbridge Wells.



CLUB NOTES



Whitstable M.C.—Special attention has been given recently to the operation of the club's Hornby Railway. The locomotives and rolling stock are kept in good order, and time-table working is always attempted. Articles in the "*M.M.*" dealing with such topics as the use of gradient posts and the filling of coal trucks are read carefully, and efforts made to introduce the methods suggested. Members also enjoy Impromptu Speech Evenings. Club roll: 16. *Secretary:* L. Dale, 77, Albert St., Whitstable.

Whitgift Grammar School M.C.—Two interesting papers on "*The History of the Surrey Iron Railway*" were read, and the route of the railway was followed on a subsequent ramble. This railway is of particular interest to members, for it passed over ground on which their new school buildings, recently opened by Prince George, have been erected. Other papers have been read on "*The Internal Combustion Engine,*" and "*Early Fire Engines,*" while a visit has been paid to the Croydon Automatic Telephone Exchange. Club roll: 32. *Secretary:* J. D. Mellor, 71, Birdhurst Rise, S. Croydon.

Sid Vale M.C.—The most important recent event was the highly successful Exhibition, for which a model Dockyard was constructed. This included two Warehouses, Tugs, Liners and Cargo Boats, Bridges, Cranes, Lorries and Trains. Many other models also were exhibited and the proceeds amounted to £3. Rain prevented the holding of Paperchases and Cricket Matches, but interesting programmes were arranged in the club room at short notice. A visit was paid to H.M.S. "*Norfolk,*" one section of the members inspecting the engine and boiler rooms, while the rest were shown the gun turrets and torpedo tubes. Club roll: 27. *Secretary:* R. Passmore, Ivedon Cottage, Newtown, Sidmouth.

St Columba's (Southwick) M.C.—Recent meetings have been held out of doors, and have included visits to Marsden Bay, where a number of caves were investigated, Tunstall Hills, and the Mayfair Toffee Works. Boldon Frog Ponds also were visited, many specimens of plant and animal life being collected there. On a geological excursion excellent fossils were obtained. Club roll: 32. *Secretary:* R. Tutin, 11, Gordon Terrace, Southwick, Sunderland.

Maidstone M.C.—Model-building Contests and talks on practical engineering subjects have formed the greater part of the programme. An interesting Lecture on "*Photography*" also has been given, and a visit paid to the Aylesford Paper Mills. Among the Competitions arranged on Surprise Evening the most interesting were one in which entrants were asked to name a number of harmless chemicals from their appearance and smell, and a second in which they had to guess the actions of the Assistant Leader from the noises he made while hidden behind a screen. Club roll: 12. *Secretary:* E. E. Stedman, 225, Tonbridge Rd., Maidstone.

Roe Green M.C.—A "Dockyard Items" Model-building Competition aroused great interest and many excellent models of Cranes and other dockyard necessaries were submitted. A special feature is made of Hornby Train Evenings. Goods traffic only is handled at present, owing to lack of space, but this is made intensely realistic with the aid of accessories constructed on Woodwork Nights. The Cricket Section closed its summer programme with a series of excellent matches. Club roll: 11. *Secretary:* P. G. Wallis, 345, Stag Lane, N.W.9.

Heywood Regent Street School M.C.—This club was formerly known as Heywood Central School M.C. The first meeting under the new name was an Exhibition, when a competition was held for the best working model submitted. This was won by the exhibitor of a Motor Cultivator, a Hammerhead Crane securing second prize. Parents of members who attended the Exhibition were greatly interested in the exhibits. Club roll: 50. *Secretary:* W. Dodgson, 31, Manchester Road, Heywood, Lancs.

Chertsey M.C.—A business meeting has been held and officers appointed for the winter session. An interesting programme has been arranged, this including a Model-building Contest. Club roll: 25. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Chertsey, Surrey.

Knowle Park (Bristol) M.C.—This newly affiliated club has held interesting meetings for Model-building and lectures. It has been decided to award points in a Sessional Competition for models exhibited, and points are also being given for the best collection of news cuttings of scientific or engineering interest. A lecture on "*Airmanship*" has been given by the manager of Bristol Airport, and a visit paid to the G.W.R. Locomotive Sheds. More members are needed and enquiries will be welcomed by the secretary. Club roll: 14. *Secretary:* G. Stirling, 6, Wellgarth Road, Knowle Park, Bristol.

Hendon M.C.—Members attended the 11th Annual Fete and Carnival in aid of the Cottage Hospital. The club Magazine, the "*Meccomag,*" is now published monthly and contains articles on engineering topics in addition to stories, jokes and competitions. Outdoor games have been very much enjoyed, and an afternoon at the swimming baths was attended by a number of members. The Hornby Railway Track has been overhauled in readiness for operations. Club roll: 13. *Secretary:* P. H. Davies, 67, Sevington Road, Hendon, N.W.4.



A flourishing Meccano Club in China. The members are keen model-builders and enthusiastic members of the Meccano Guild, the attendance record at meetings seldom falling below 100 per cent. Fretwork and Stamp Collecting are the chief additional hobbies of members.

Ainsdale M.C.—Cycle Runs, Cricket Matches and Rambles were the chief features of the outdoor programme, and all were well attended. A party of the members and the Leader and Secretary spent a camping holiday in North Wales. Club roll: 12. *Secretary:* J. Aspinall, 10, Shore Road, Ainsdale.

Clacton and District M.C.—A very enjoyable tour of the local Gas Works took place some time ago, and the members were greatly interested in everything that was shown to them. A Cricket Team organised for the summer months was very successful, and Cycle Runs provided a change from the usual programme. A number of new features have been introduced into the winter programme. Club roll: 16. *Secretary:* M. H. Carter, 12, Wellesley Road, Clacton-on-Sea.

Ipswich M.C.—The Second Annual Camp was held at Felixstowe, and a party of members had a very happy time together. The Headquarters of the Felixstowe Fire Brigade were visited, and at the invitation of Commander Johnson the members went to Shotley, where they were shown round H.M.S. "*Ganges.*" Commander Johnson takes a keen interest in the club, and has visited it on many occasions. His recent talks on "*The Battle of Jutland*" and "*Battleships*" were received with much enthusiasm. Club roll: 25. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.

King's Lynn M.C.—A visit was paid to the local newspaper printing works. Another interesting event was an outing to the Middle Level, a few miles from King's Lynn, where a new sluice is being constructed. A good programme has been drawn up for the winter session. Club roll: 22. *Secretary:* A. S. W. Horn, Stanton House, The Chase, King's Lynn.

Twenty-Eight (Edinburgh) M.C.—Model-building continues to be the chief attraction, the super models constructed including the Harmonograph, and the Hydraulic Crane. The club now possesses an extensive range of Meccano parts and carefully planned cardboard boxes have been made to contain these. Interesting lectures and demonstrations have been given on "*Lead and Zinc Manufacture,*" and "*Map Engraving.*" A talk on "*Lithography*" by one of the senior members was informal in character, members being allowed to bombard the lecturer with questions. His replies were illustrated by means of examples of lithographic work. Members climbed Arthur's Seat on a very successful ramble. Club roll: 16. *Leader:* Mr. Jas. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

Sketty (Swansea) M.C.—Members have been busily engaged fitting the new club room with shelves and a tool rack. A Hornby Railway runs round the room and the track is fitted with accessories, many of which have been constructed from Meccano parts. New members are required and enquiries should be made from Mr. A. Lawrence, 60, Beechwood Road. Club roll: 12. *Secretary:* W. M. Thomas, Greenhill Post Office, Swansea.

St. Feock School M.C.—Lectures on "*First Aid*" by Miss Butler, followed by practical exercises, were an especially interesting feature. Other activities have included Model-building and Leather Work. The chief models constructed have included one of the Sydney Harbour Bridge, Fire Engines. Airships and Omnibuses. Excellent progress has been made in Leather Work, and a number of purses made by members have been sold. A Gramophone Concert has been held, and an interesting paper on "*The Life of a Bee*" was read by a member who is only nine years of age. Club roll: 9. *Secretary:* J. Rogers, West Trevilla, St. Feock, Nr. Truro.

Australia

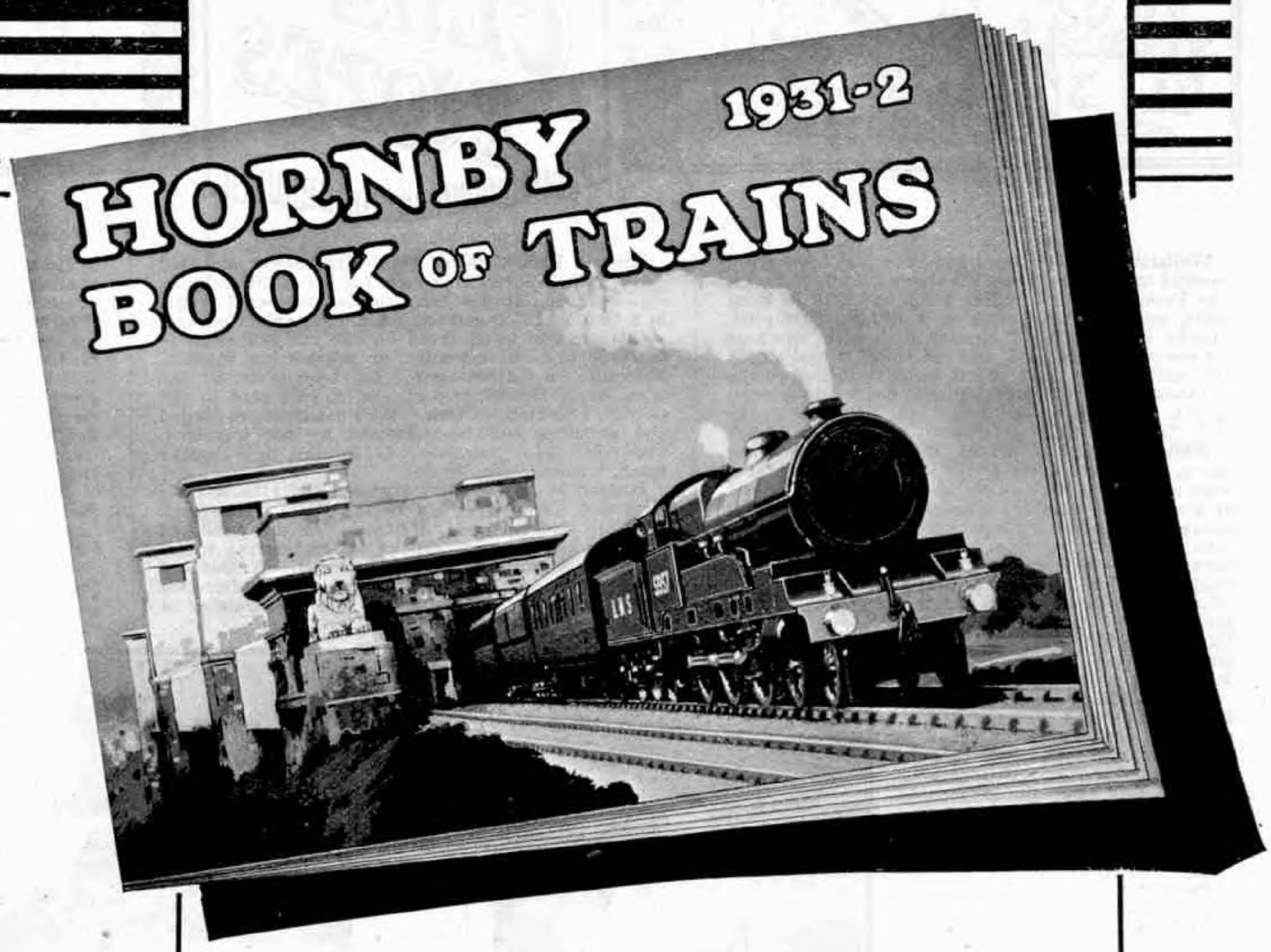
Ravensthorpe M.C.—A successful Concert has been given, proceeds being on behalf of club funds. Later the Concert was repeated and this time the whole of the receipts were given to the local hospital. An interesting debate has been held on "*Football: Association v. Australian Rules.*" Interesting reports of club meetings now appear regularly in the local newspaper. The club's affiliation certificate has been framed and hung in the club room. Club roll: 14. *Secretary:* P. O. Blake, Ravensthorpe, Western Australia.

Thebarton Technical High School M.C.—Interesting Model-building Competitions have been held. Entrants were allowed to choose their own subjects, the models being judged in accordance with the sizes of the Outfits from which they were made. Visits of exceptional interest have been made to the West Adelaide Automatic Telephone Exchange, the Tramway Workshops and Power House, and a local Picture House, where the sound film projecting apparatus was inspected. Papers have been read by members on a number of interesting topics. Club roll: 30. *Secretary:* A. Haegi, 4, Grace St., Hyde Park, South Australia.

Woodville M.C.—Models brought to meetings by members have included Bridges, Locomotives, Girder Cranes, and Motor Chassis. An evening was devoted to each type and the Leader gave an explanatory talk on each occasion. The Library now contains copies of Meccano Manuals and "*Meccano Magazines,*" and engineering books are to be added. At one meeting a large model of a bridge designed by the Leader was erected from sections built up by members at home. Club roll: 7. *Secretary:* D. R. Patrick, 22, "The Grove," Woodville, South Australia.

New Zealand

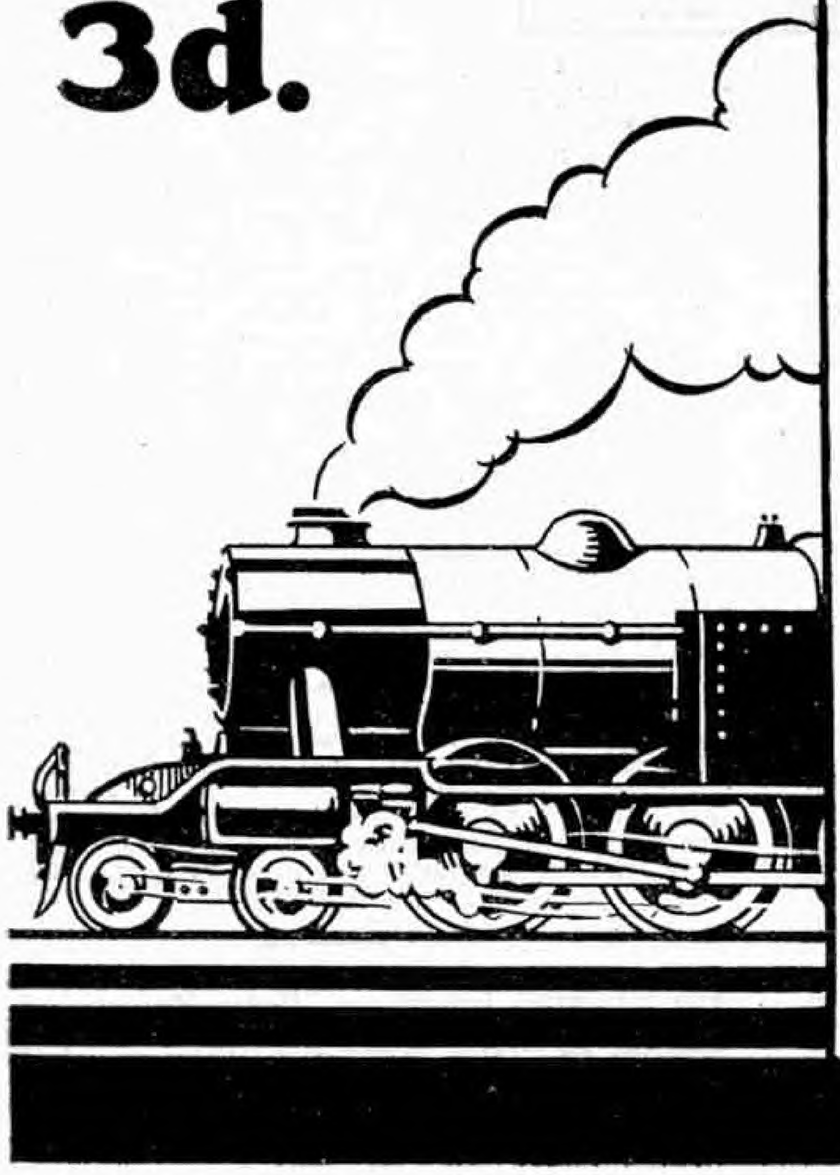
Hawera M.C.—Mr. A. H. Larkman, Leader, gave two interesting lectures on "*Useful Models,*" and "*Animal Traps.*" Other talks have been given by members on "*James Watt,*" and "*The Flags of all Nations.*" Drawing Contests have been held and members continue to take part eagerly in Model-building Competitions. Club roll: 14. *Secretary:* B. Cox, Tawhiti Road, Hawera, N.Z.



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Branch Notes

PORTSMOUTH (NORTH END).—A successful Exhibition has been held. The trains made up included an open truck train, a petrol special, a mixed goods, an express goods train, a motor train, and several passenger trains. Advice on the making up of miniature loads in the H.R.C. pages of the "*M.M.*" was followed. Electric light signalling was used and the stations were also electrically lighted, all lights being controlled from a Meccano switchboard. The track was operated by seven members. Two Meccano models loaned by Headquarters were displayed, together with models made by the Branch. Visits to Fratton Sheds and the "*Evening News*" offices are being arranged. Secretary: D. Cole, 90, Emsworth Road, North End, Portsmouth.

ELMSIDE (EXETER).—The Branch track has been screwed down to give smoother running, and four more points have been added. Two container trucks were made by a member, and these are realistically loaded and unloaded by a Meccano Crane. Goods traffic is proving more interesting than passenger work, and the Branch is concentrating on this side of railway operation for the time being. A careful study of train working at Exeter Station is being made. Secretary: J. R. G. Blaker, c/o 60, Elmside, Exeter.

FIRST KINGSTON-ON-THAMES. — Some interesting outdoor track meetings have been held. Trains were run from the main station to two "Seaside" termini, passing through a tunnel constructed under a rockery on their way. Owing to the slope of the garden in which the track was arranged, suitable gradients were obtained in a realistic manner. The "Seaside" termini were arranged close together, and to avoid the use of a turntable a triangular junction was laid out between them, which resulted in a great saving of time. Several locomotives were in use and some very good loads were dealt with. At the least sign of rain the locomotives were despatched, together with the rolling stock, to the shed housing one of the "Seaside" termini, and the track was covered over with boards. Secretary: C. W. Lex, 19, Richmond Park Road, Kingston-on-Thames.

HENDON.—The reconstruction of the station buildings to scale size in three-ply wood has been commenced. It has been decided to adopt Hornby Signal Arms in the construction of lower quadrant signals to be worked either by electricity or wires. Several control points have been wired to the lever frame, and the track tunnel has been re-roofed. Secretary: P. H. Davies, 67, Sevington Road, Hendon, N.W.4.

ST. NICHOLAS (BIRMINGHAM).—Track meetings are held regularly each week, and are invariably operated to timetable. A circular cycle run was held, and members watched the "Penzance Express" hauled by the locomotive "*Lady Godiva*" pass through Earlswood. Secretary: John E. Wilson, 23, Meadow Hill Road, King's Norton, Birmingham.

SWANSEA MODEL RAILWAY CLUB.—The Branch track has been altered and added to, and new shelves and tool racks have been fitted round the room. At a recent meeting the Chairman announced that tenders were invited for the building of station buildings, engine sheds, etc., to scale! Locomotive tests were held and 15 locomotives took part. Secretary: W. M. Thomas, Greenhill Post Office, Swansea.

HERNE HILL.—The first Branch meeting was held at the Chairman's house, and an extensive layout was prepared. The Chairman took the members to the Croydon Aerodrome, and accompanied by a guide they were allowed to make a tour of all the hangars. "*The Model Engineer*" Exhibition was visited, also the London Bridge Power Signal Box. Secretary: John Nunn, 70, Herne Hill, London, S.E.24.



A few of the members of the Whitgift School Branch No. 67 and Meccano Club. Chairman, Mr. F. Broadbent, and Secretary, J. D. Mellor. This Branch was formed two years ago, and has been actively engaged in model railway work ever since. Visits of railway interest, lectures and debates are important features of the programme.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BIRMINGHAM—D. W. Robertson, "Oakholme," Hampton-in-Arden.

BRISTOL—Mr. C. Stiddart, 48, Broadwalk, Knowle, Bristol.

HEREFORD—R. J. M. Lee, St. Margaret's, Ferndale Road, Hereford.

HORWICH—T. W. Backhouse, The Vicarage, Horwich, Nr. Bolton.

LEYLAND—G. E. Cocker, 101, Towngate, Leyland, Lancs.

LUTON—S. W. Horn, 7, Selbourne Road, Luton, Beds.

SANDERSTEAD—S. Vertue, 14, Glossop Road, Sanderstead, Surrey.

ST. ALBANS—A. W. West, 6, Oswald Road, St. Albans, Herts.

SHOREHAM-BY-SEA — J. Bishop, "Silverton," Lower Beach Road, Shoreham-by-Sea.

STEVENSTON—M. Fitzpatrick, 15, Station Road, Stevenston, Ayrshire.

WIGAN—Mr. H. R. Shaw, 447, Wigan Road, Bryn, Nr. Wigan.

WORTHING—R. Jupp, 1, Brougham Terrace, Brougham Road, E. Worthing.

OVERSEAS

AUSTRALIA—Allan Dempster, De-Aar, King Street, Warwick, Queensland.

AUSTRALIA—Mr. H. H. Matthews, 27, Ross Street, Parramatta, N.S.W.

U.S.A.—Mr. Harold Loose, 7709, Colonial Road, Brooklyn, N.Y.C.

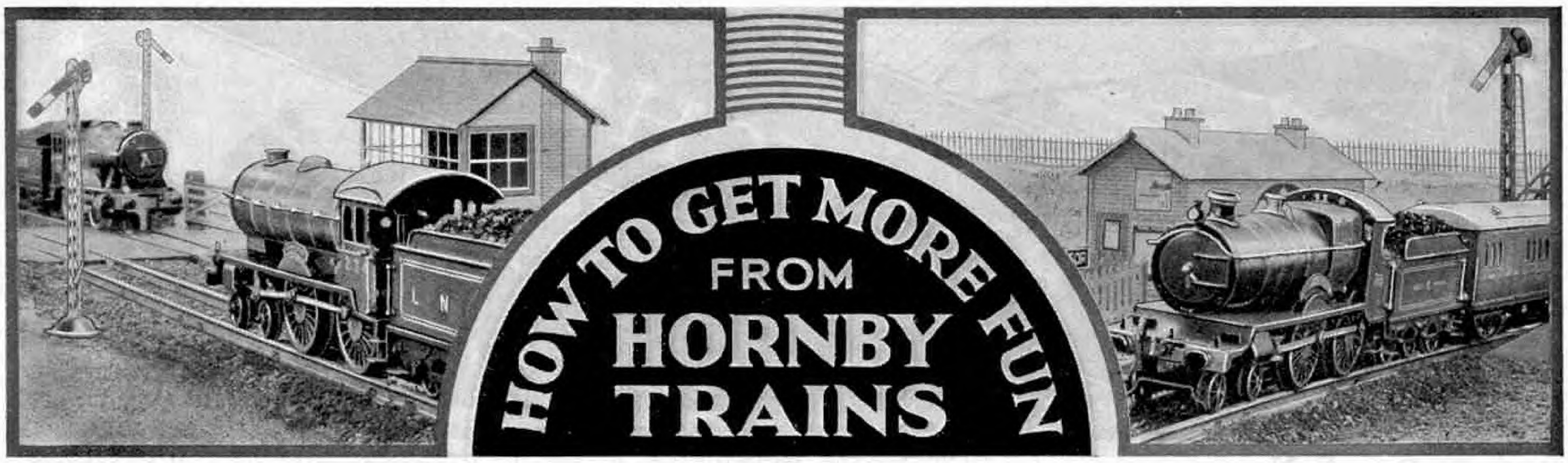
FRANCE—E. Bailey, 175, Bld. de Lille, Marq-en-Baroeul, Lille, Nord, France.

Further Incorporated Branches

196. RAYLEIGH—H. Arbin, 30, Eastwood Road, Rayleigh.

OVERSEAS

197. "THE MINTON" (N.Z.)—J. R. Fisher, 107, Normans Road, Papanui, Christchurch, N.Z.

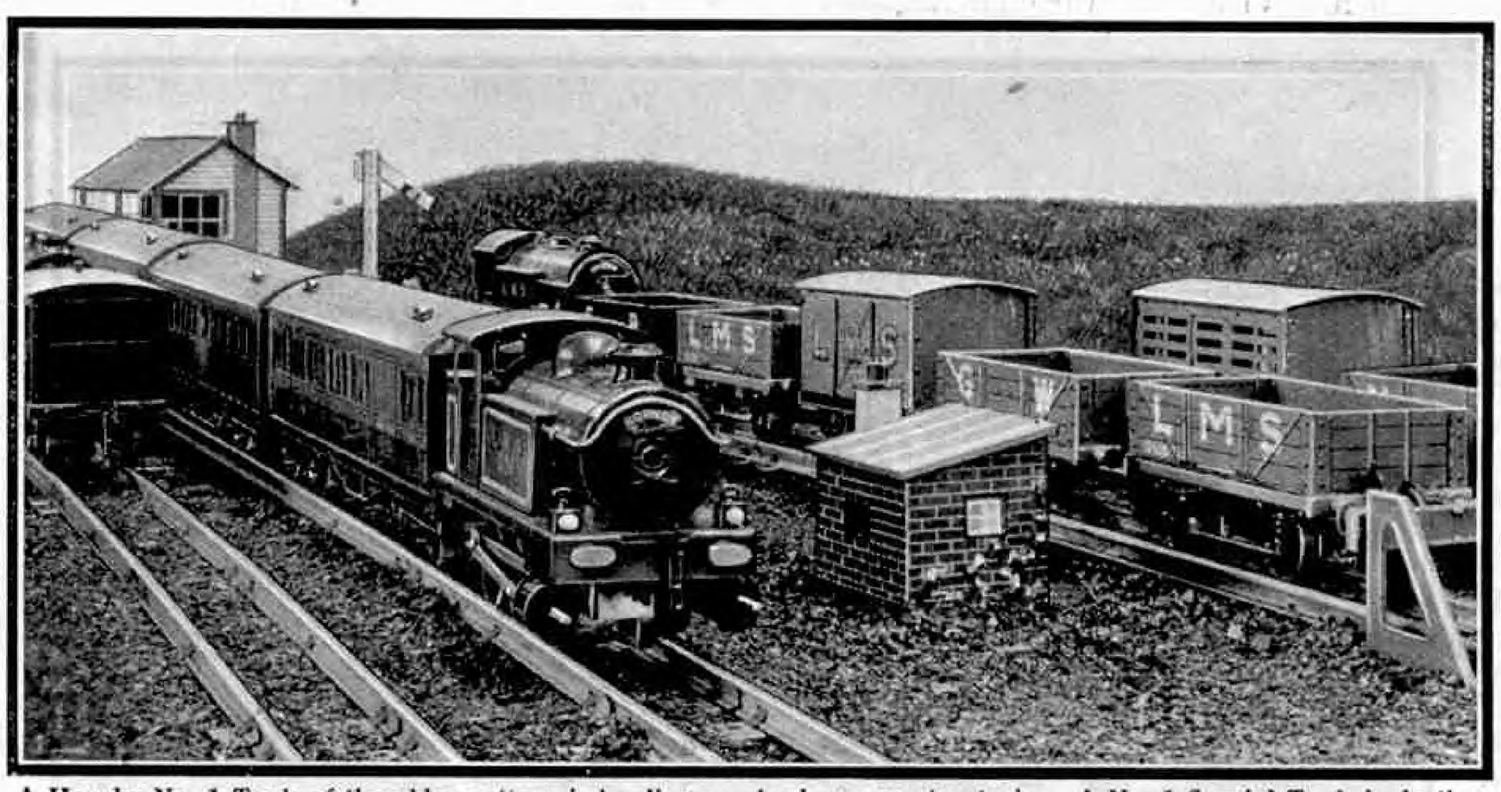


XXXVII.—TANK LOCOMOTIVES ON HORNBY LAYOUTS

IT is remarkable that the tank locomotive should be neglected by so many miniature railway enthusiasts.

The reason for this probably is the fact that on real railways, tender engines are thought to be the more important of the two types. Many of the more spectacular duties certainly are performed by tender engines, but a very useful and indeed indispensable contribution to locomotive work is made by tanks.

The name "tank" applied to an engine implies that it carries supplies of fuel and water upon its own frame, and does not depend upon a separate vehicle for their conveyance. One of the earliest locomotives of this kind was the "*Novelty*," the engine built by Braithwaite and Ericsson for the Rainhill trials in 1829. Tank locomotives therefore trace their ancestry to the earliest days of railways. Since then they have done invaluable work in real practice and their miniature Hornby reproductions are equally useful on model railways.



A Hornby No. 1 Tank of the older pattern is hauling a suburban non-stop train. A No. 1 Special Tank is dealing with some wagons in the siding.

Hornby enthusiasts are well provided for in the matter of locomotive power. The available range includes a number of excellent tank engines and there are many opportunities of making use of them. A miniature system may be operated exclusively by means of tanks and without losing realism, for there are sections of line on real railways on which tank engines reign almost supreme and the appearance of a tender engine in normal working is rare. In addition, there are certain duties that are always carried out by a tank locomotive, even though tender engines are available at the same time. This is due to the ease with which tanks may be run in both directions. Their employment makes the use of a turntable unnecessary, for when such an engine reaches the end of its journey it is merely run to the other end of the train in order to be ready for the return trip. Tank engines therefore are handier than tender engines. In addition, they do not take up so much space. They are more easily accommodated in a crowded shed, and their use also saves a certain amount of space in a busy terminal station.

It will be seen that tank engines offer many advantages to the owners of miniature railways on which the restrictions of space are severely felt. The largest tank engines in the Hornby Series are the No. 2 Special Tank and the No. 2 Electric Tank Locomotives. These are of the 4–4–2 wheel arrangement and in their general design are similar to many engines in actual practice. They are very suitable not only for heavy suburban duties, but also for fast-timed stopping trains that are run for some distance outside the "suburban area." It is on these duties that the handiness of the tank engine is most appreciated, for on arrival at the terminus the engine may be made ready for departure in a very short time.

Tank engines have great possibilities in regard to employment on express services, and many of them actually are engaged on quite heavy and fast duties. Of course, the most important "crack" expresses are not usually handled by such engines, but no doubt in an emergency a suitable large tank engine might be used where no tender engines were available. On the Southern Railway, however, wide employment is found for tank engines on expresses where the distances to be run are comparatively short. Formerly the "*Southern Belle*" was hauled regularly by tank engines in turn with tender express locomotives. The 4–4–2 tanks of the former L.B.S.C. Railway first performed this duty; then came the 4–6–2's, and finally the massive 4–6–4's or "Baltics." Now a "King Arthur" tender engine is usually at the head of the train.

The L.M.S.R. and L.N.E.R. also make good use of large tank engines in various districts, and thus there is good reason for the employment of No. 2 Special Tank or No. 2 Electric Tank Locomotives for fast services on model layouts. We illustrate one of these engines hauling a fast three-coach Pullman special. The engine has a massive appearance and with the handsome Pullman coaches makes up a very attractive train. The interest and convenience of running trains with the

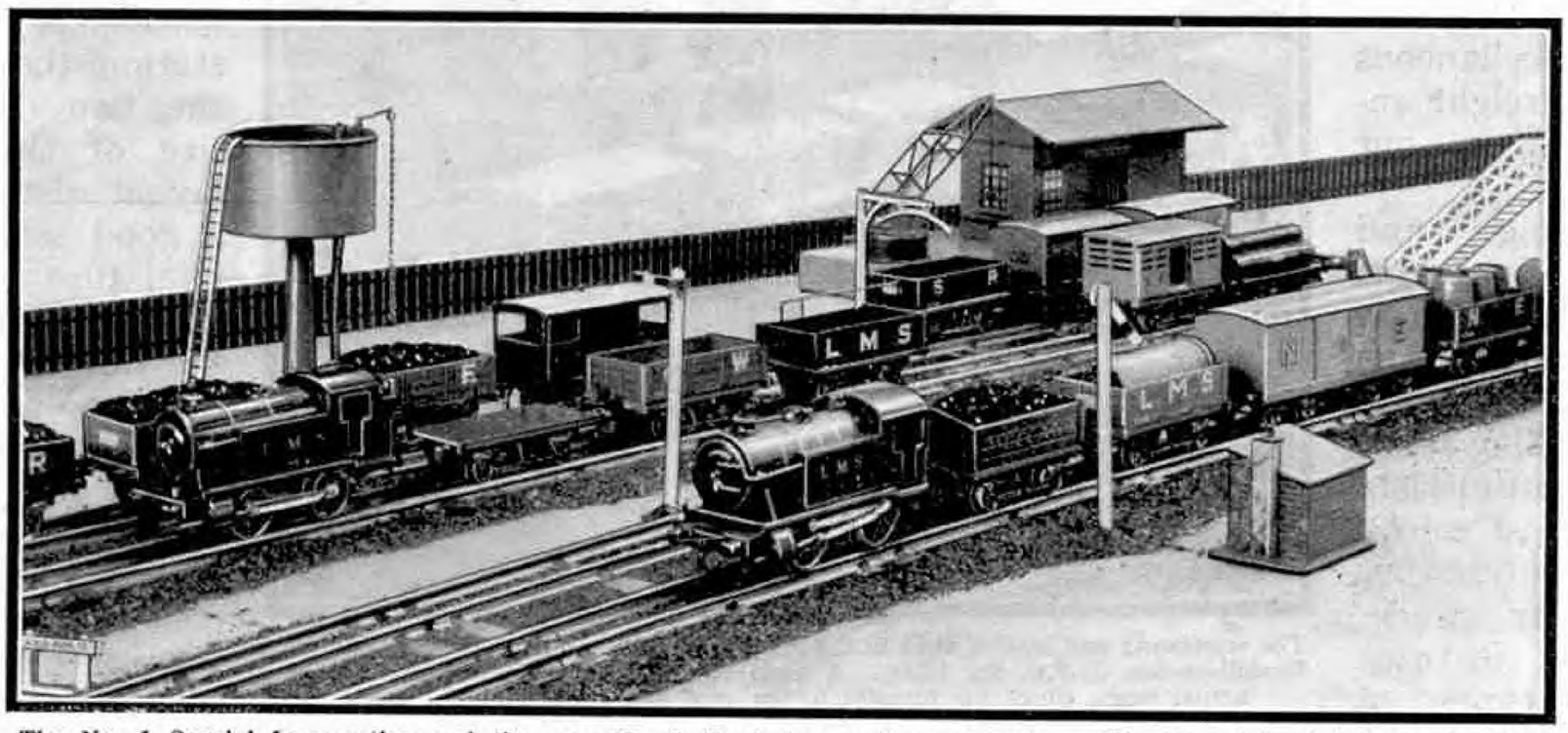
aid of these tank engines will make up for the lack of the glamour that surrounds an express tender engine, even in miniature.

For less important and heavy all-round work generally, the No. 1 Special Tank has many features to recommend it. Among the tank engines it occupies a similar position to its tender counterpart, and is equally useful on miscellaneous duties. It will haul heavy suburban trains and also is suitable for goods work, as may be seen from one of our illustrations in which an engine of this type is shown at the head of a mixed goods train. Its wheels are of moderate size and give it good haulage power, but it does not lack speed. It is a worthy representative in miniature of the large number of useful tank engines that have driving wheels round about 5 ft. 6 ins. in diameter. Outside cylinders are fitted and in form and position the dummy steam pipes resemble the real ones on the most recent L.N.E.R. and G.W.R. 2–6–2 tanks. It is up-to-date in every way and has the large boiler and squat mountings that are so popular with many miniature railway owners.



A three-coach Pullman express hauled by a Hornby No. 2 Special Tank Locomotive. This engine and the similar No. 2 Electric Tank are quite suitable for express duties.

It would be difficult to find an engine that is more generally useful than the No. 1 Special Tank Locomotive. One great advantage it possesses is that it can be accommodated in the No. 1 Engine Shed. This is a decidedly useful feature on a layout where space is limited, and the accommodation for locomotives correspondingly curtailed. Similarly, at a terminal station where a run-round loop is provided, the length of rail beyond the points need only be very short. The saving of space thus realised may make all the difference between providing run-round facilities and doing without them.



The No. 1 Special Locomotive and the new No. 1 Tank Locomotive at work. The No. 1 Special is at the head of a heavy mixed goods train on the main line. The second engine, using the Fibre Wagon as a shunter's truck, is busy in the goods yard.

This engine may be used in "hump" shunting, a practice that is now becoming extremely popular among Hornby Train enthusiasts. For propelling wagons up the slope of the "hump" a powerful engine is necessary and a No. 1 Special Tank is admirably adapted for the purpose. Its length of run also is extremely satisfactory and several trips round a continuous layout of average size may be made without re-winding. The behaviour and good qualities of this engine have made it indispensable on many lines, in fact, and we know of many small layouts on which the only locomotives employed are No. 1 Special Tanks.

For lighter services generally, a smaller engine is desirable and the Hornby No. 1 Tank Locomotive fulfils all requirements in this direction. The latest pattern of this engine is shown in one of our illustrations and its resemblance to the No. 1 Special Tank is apparent. Hauling local passenger and goods trains are particularly suitable duties for this engine, while shunting operations of all kinds may keep it busily engaged on a miniature layout. It is a worthy successor of the older No. 1 Tank, with which all Hornby Train enthusiasts are so familiar, and in its capacity for manœuvring and hard work is equal to its famous forerunner. The lines of the older engine are preserved in the No. 1 Electric Tank, which is equally handy on an electric layout. As this engine is fitted with a permanent magnet motor, it may be braked and reversed without actual handling, complete control from the switchboard being possible by means of the combined Reverse and Resistance Controller. This locomotive therefore is particularly useful to owners of miniature electric railways. It may only be used with low voltage direct current from an accumulator and cannot be run off the mains current.

The Hornby No. 1 Tanks generally are representative on a small scale of a very large number of tank engines in service on our railways that in spite of their moderate size, haul prodigious loads during suburban "rush hours" or deal busily with local goods traffic.

The smallest tanks on real railways are used for shunting in stations, goods yards and on dock premises. These are now represented in the Series by the new M3 Tank Locomotive. This is similar to the No. 1 Tank but represents an inside-cylinder prototype. It has a reversing mechanism and is extremely useful.



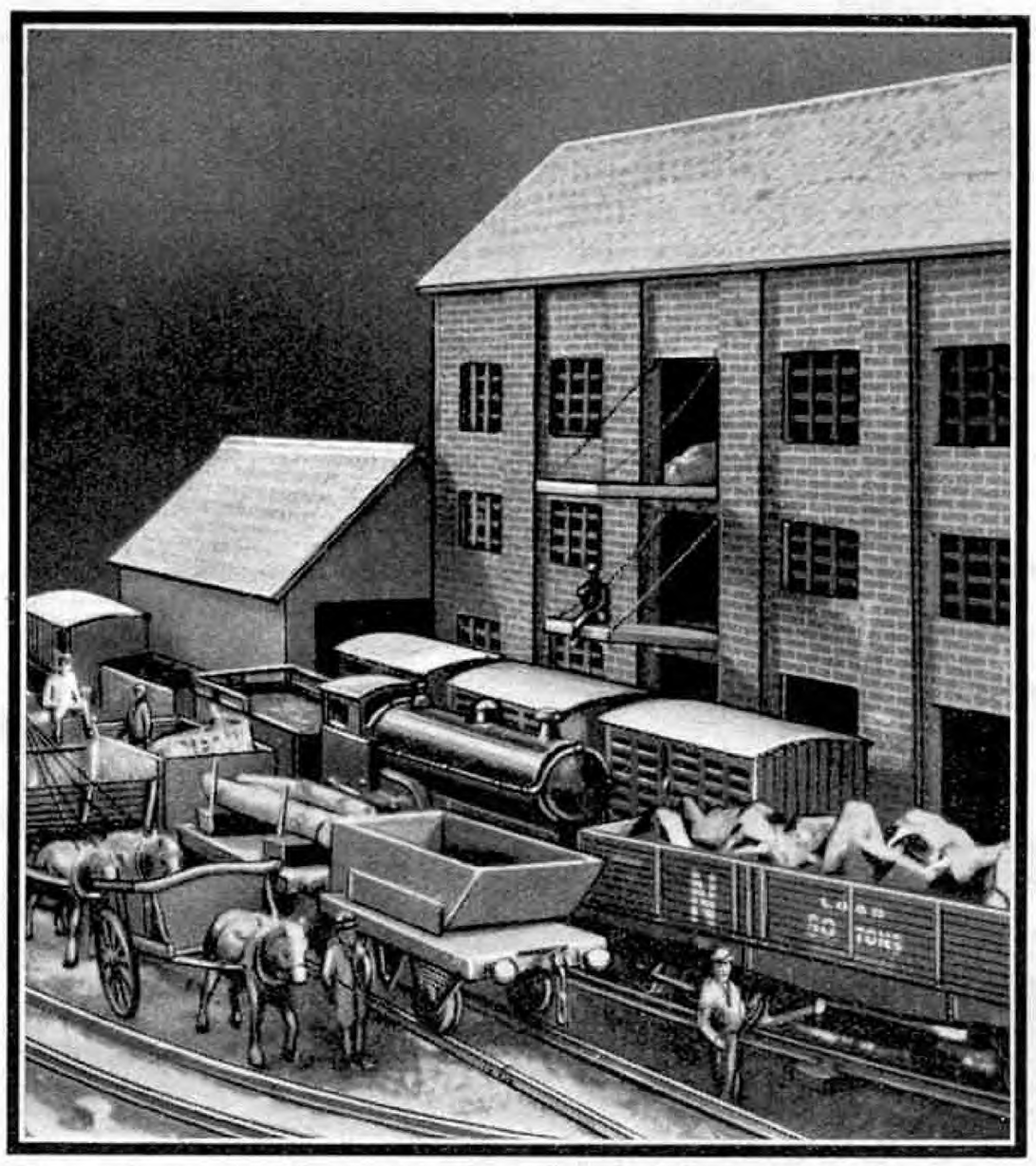
XXXV.—GOODS YARDS AND DEPOTS IN MINIATURE

IN general discussions on railway work greater prominence usually is given to passenger trains, particularly to famous expresses and the powerful locomotives that haul them, than to goods trains. Goods traffic is actually the more important of the two to our railways, however, for it contributes more to their revenue. It is heaviest by night and this perhaps accounts for its being neglected by a number of railway enthusiasts. In addition, its attractions are not increased by the fact that the wagons composing a goods train and the locomotive at its head are not usually groomed so carefully as a crack train or an express locomotive. Goods trains generally are of great interest because of the great variety of the wagons employed, however. The wide range of goods vehicles in the Hornby Series is a proof of this, and illustrates the miscellaneous character of the freight requiring transport on our railways.

The marshalling and operation of goods trains offer great possibilities on miniature railways and the splendid choice of Hornby locomotives and rolling stock available enables enthusiasts to obtain the greatest enjoyment from this interesting section of railway work. The characteristic features of the various types of engines and wagons are being dealt with in the "*M.M.*" from time to time by "Tommy Dodd," and the actual make-up of goods trains also has been discussed recently in these pages. We now propose to complete a general survey of goods traffic by consideration of the yards in which the trains are shunted and marshalled, and the sheds and depots where loading and unloading are carried out.

On miniature layouts, where space often is restricted the simple wayside type of goods yard is usually laid out. The Goods Platform of the Hornby Series is typical of those of many goods stations of moderate size up and down the country. It should certainly find a place on every layout where it can be accommodated, therefore. It does not take up much space, for the platform is $16\frac{3}{4}$ in. in length and 6 in. in width, but it is so useful and effective that it may be regarded as essential.

In planning the layout of a goods yard the remarks made in these pages last month should be borne in mind and loop lines installed in preference to dead-end sidings wherever possible. There is not always room for loops, however, and where this is the case, the layout should be so arranged that shunting movements may be carried out clear of the main line, or at any rate with as little interference to main line traffic as possible. The actual position of the goods shed or depot with reference to other features of the layout also requires careful thought. Except in large centres, a goods shed usually is near a passenger station, the distance between the two depending on the size of the yard and the layout of the road. This is a good scheme to adopt in miniature railway work, provided that it does not cramp the yard layout in any way or interfere with the management of traffic either in the yard or the passenger station.

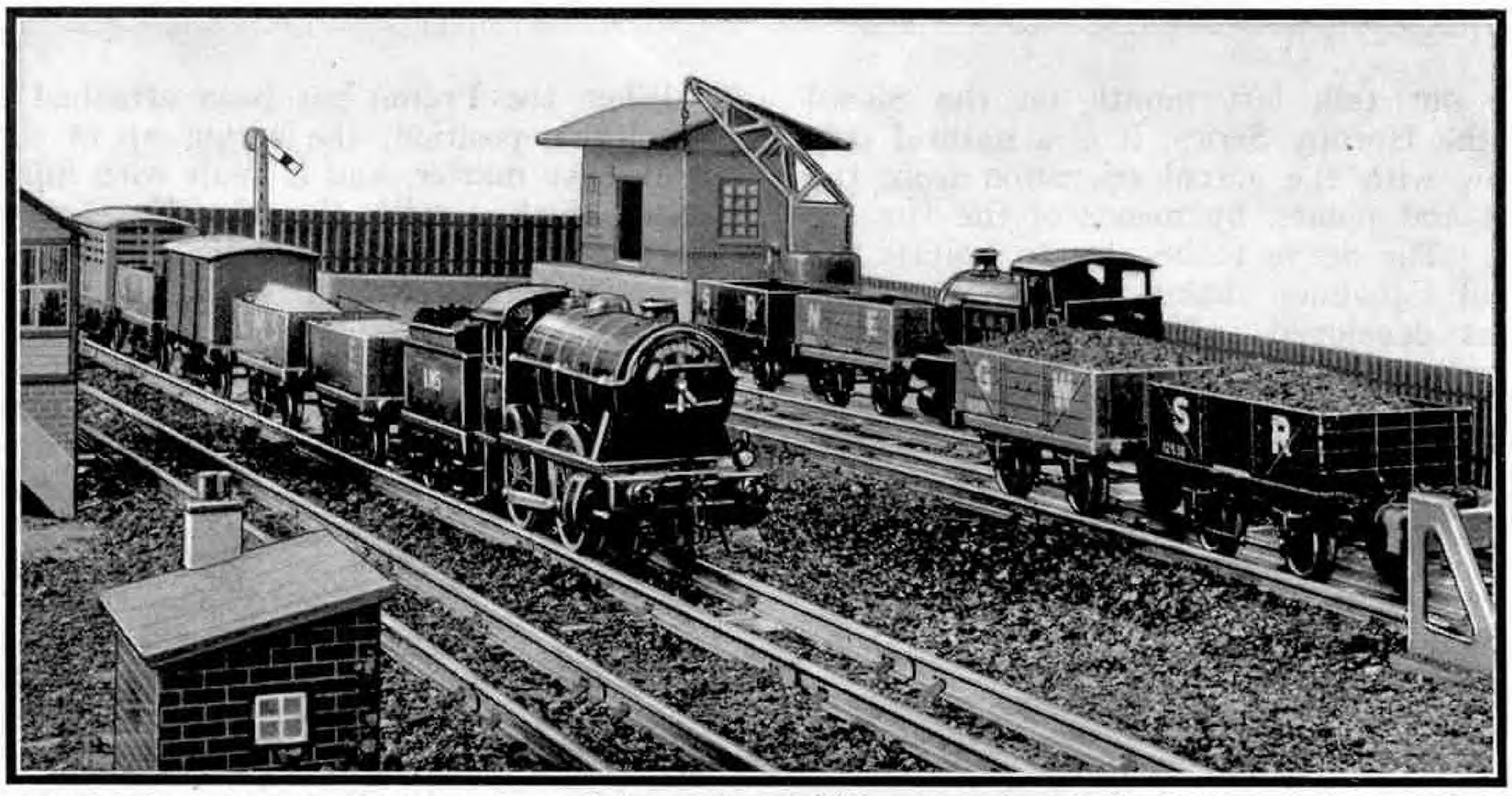


The warehouse and loading shed in the goods yard of the layout of P. B. Denny, Bexhill-on-Sea (H.R.C. No. 1587). A great feature is made of the carriage of actual loads, which are brought to the yard and taken away by road.

On the popular oval types of layout there usually is a passenger station at a convenient place on one of the straight sections of the track, and the corresponding goods station is arranged in the nearest corner. The goods lines then run up to buffer stops placed against the wall. This gives a dead-end yard, of course, but the plan has the advantage that the space in the corner is filled in a useful manner. If the width of the layout is not too great the traffic in the yard may be easily handled from a central operating space. If the main line is made up of double track at this point, a crossover should be provided between the up and down lines to give a way into the yard to trains on the inner road of the main line. The crossover should be so placed that trains entering the siding from this line have as direct a run-in as possible. These trains should not have to carry out any reversing

movements on the outer road, for in doing so they might delay a passenger train. If the goods train can be run over the crossover directly on to the goods yard points the main line is only momentarily blocked.

As it is now the usual practice among Hornby enthusiasts to make up actual loads for their goods trains, the yard should be well equipped for dealing with the various articles of freight. The Hornby Goods Shed is provided with a crane at one end of the platform in order that such items as miniature cases, crates and bales may be loaded easily into the open wagons or hoisted out of them. Since the crane can be revolved by means of a crank handle and worm gear it may be used in loading or unloading on each side of the platform. The position of the crane enables it to be used to handle goods in wagons standing on a line run up to the end of the platform, as is frequently done in real practice for loads that have to be dealt with endways. It is thus possible to deal with wagons on three separate tracks by means of a single crane.



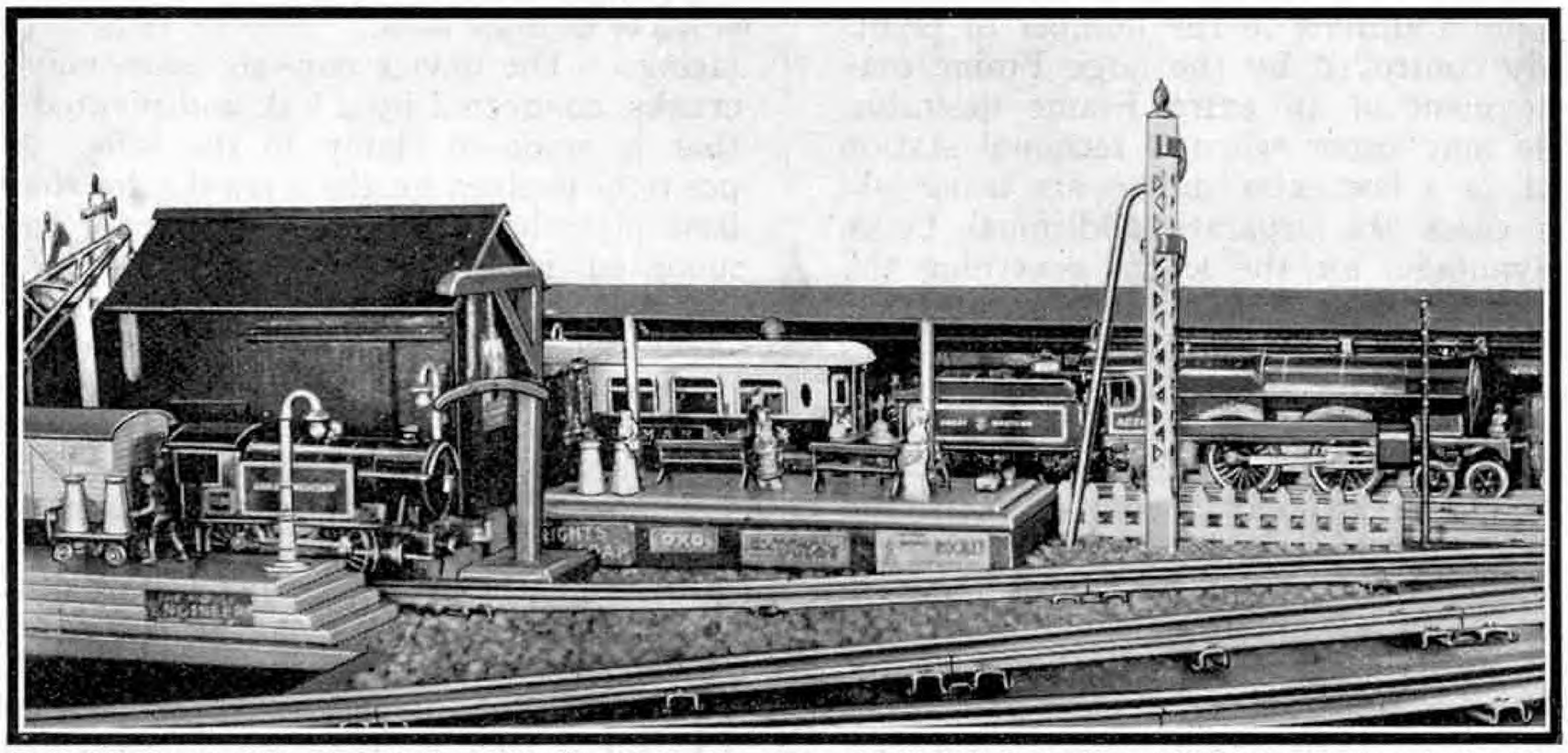
A goods train passing a wayside goods yard. On the layout shown, realistic use is made of the Hornby Goods Platform, which is in a convenient position typical of that occupied by goods platforms in many small station yards.

If further crane power is necessary — and in handling long loads, such as logs and timber, it is certainly desirable — the separate Platform Crane may be installed in a convenient place. If the amount of freight of this kind is not sufficient to make two cranes necessary, however, the Crane Truck or Breakdown Crane may be brought along from the locomotive depot when required. This is a scheme employed in actual practice when special loads beyond the capacity of local equipment have to be dealt with.

The shed portion of the goods station has a sliding door on each side and may be employed as a warehouse for storing goods until required. This is a particularly useful feature on a miniature system.

Where the central operating space is fairly extensive, a goods depot may be arranged inside the main track and marshalling facilities may be provided if traffic is heavy. This scheme allows greater room for the expansion of the yard on a large layout than the one already dealt with, and is very convenient for operating. An interesting example of this type of goods yard is included in the layout of P. B. Denny of Bexhill-on-Sea (H.R.C. No. 1587), which was described on p. 414 of the "*M.M.*" for May. A portion of the goods yard on this miniature railway is shown in one of our illustrations. A great feature is made of goods traffic on this railway, as is evident from the size of the warehouse erected to deal with it. Actual loads are handled, of course, and road transport also is represented. The equipment as a whole is very complete and to increase the speed of marshalling operations a small "hump" is provided at the entrance to the yard.

Where special attention is given to goods working on an oval layout it is useful to have a line running diagonally across the central space to connect opposite sections of the main line. This forms an excellent "goods reception road," from which sidings may be run in either direction in order to make two yards, one on each side. Operations on such a layout are very interesting and productive of a great deal of fun, particularly if two or more enthusiasts unite their resources. Trains may arrive and be broken up in the yards and in redistributing the wagons they may be transferred from one yard to the other. Two shunting engines may easily be kept extremely busy during marshalling operations in a yard of this kind.



Part of the layout of Mr. W. G. Bosley of Nursling, Nr. Southampton. A milk train is standing at the loading platform in the left foreground, and on the main line an express is passing the goods shed.

Loading gauges should be found in convenient places in every goods yard, of course, and if Hornby Lamp Standards are installed they add to the completeness of the effect and give the impression

(*Continued on page 944*)

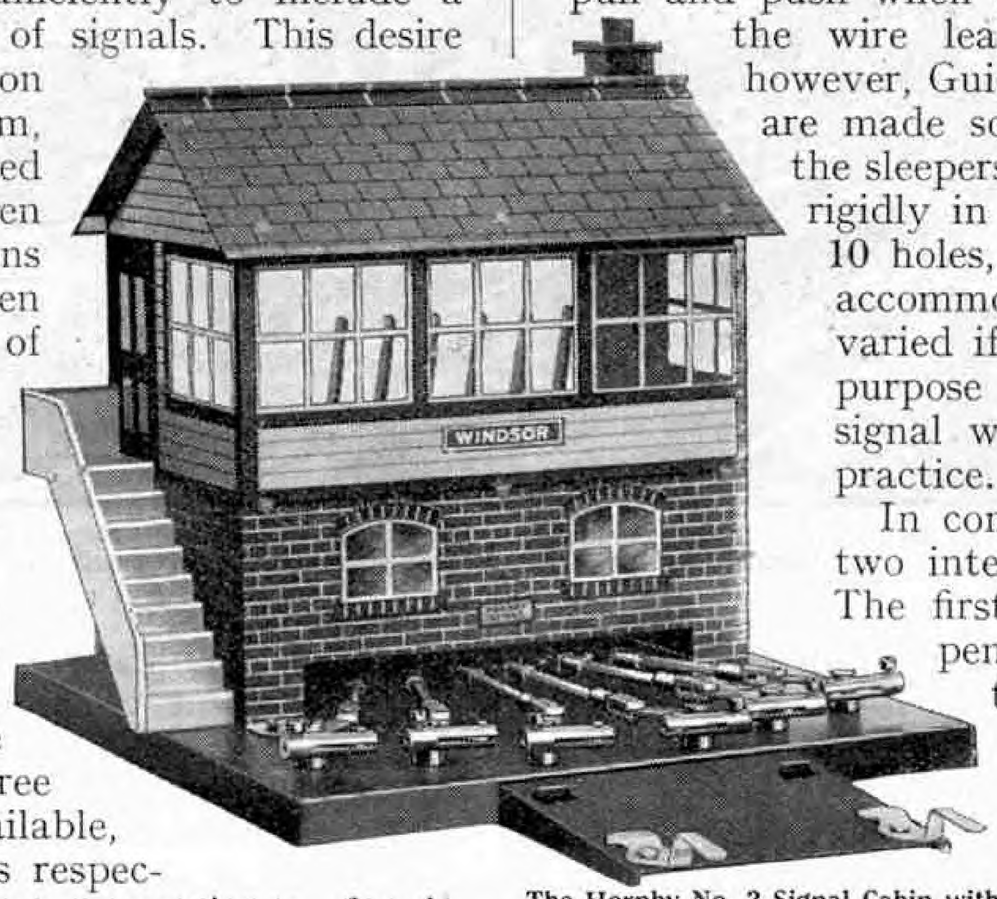
Components of the Hornby Control System

By "Tommy Dodd"

FOLLOWING our talk last month on the Signal Cabins of the Hornby Series, it is a natural step to deal now with the actual operation from the Cabin of signals and points, by means of the Hornby Control System. The desire to be able to imitate the work of the real signalmen makes itself felt as soon as a layout has developed sufficiently to include a more or less complete system of signals. This desire can be realized by the installation of the Hornby Control System, which was successfully introduced some years ago, and has been greatly improved by modifications and additions that have been made this season. A review of the principal components and their functions will therefore be useful to Hornby Railway owners and of interest to readers generally.

The first and most important item in the Control System is the Lever Frame, by means of which points and signals may be operated from the Cabin. Three sizes of Frame are now available, having two, four and six levers respectively. This choice is a great convenience, for in certain places the Six-Lever Frame may be too large, and in others some additions to the number of points or signals already controlled by the large Frame may make the employment of an extra Frame desirable. Instances of this may occur when a terminal station is being enlarged, or a few extra sidings are being laid down. In such cases the separate additional Lever Frame is an advantage, for the levers governing the particular platform roads or sidings involved are thus concentrated near to the points or signals controlled. Separate cabins for such purposes are frequently seen in actual practice, though sometimes only a "ground frame" with no cabin is used.

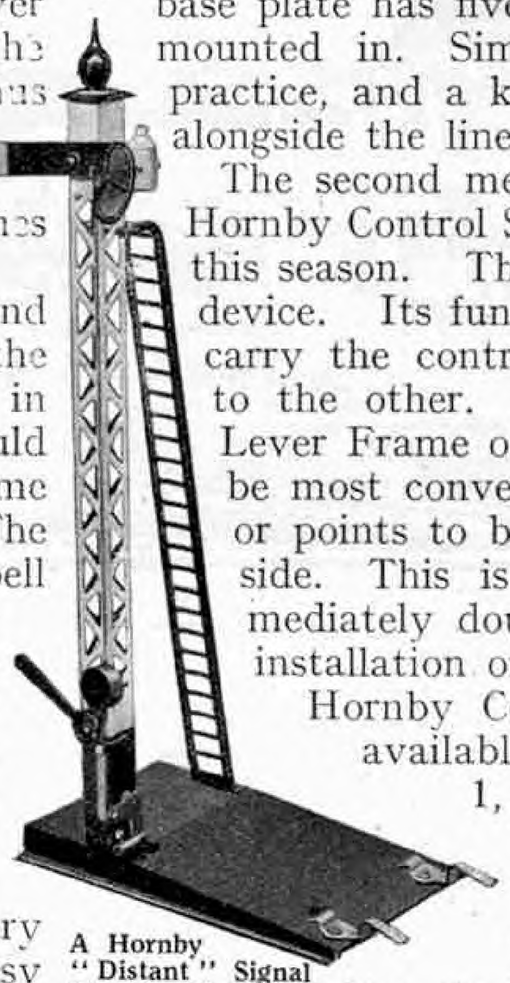
The Lever Frame is strongly made to withstand the wear and tear to which it is subjected, for the out-of-scale human hand applies far more force in pulling the levers than a miniature signalman would do. The general construction of the Six-Lever Frame is shown in the upper illustration on page 919. The levers are connected at their lower ends to the bell cranks situated on the large base upon which the Frame and Cabin are mounted. To make the whole assembly secure, provision is made to attach this base to the track. A projection fitted to the front of the base passes underneath the rails like a large sleeper, and pivoted clamps enable a rigid attachment to be made. When the Signal Cabin is placed over this assembly the whole appearance is very realistic. The handling of the levers is quite easy owing to the special hinged roof and back of the Cabin, described last month.



The Hornby No. 2 Signal Cabin with the Six-Lever Frame installed. These components are mounted on a large base which is attached to the rails by the clamps shown.

When the Frame has been attached to the rails in a suitable position, the wiring up of signals or points is an easy matter, and is dealt with fully in the special leaflet dealing with the Hornby Control System. If the signals or points controlled are close to the frame, the wire is stiff enough to stand up to the alternate pull and push when a lever is operated. To support the wire leading to signals at a distance, however, Guide Brackets are necessary. These are made so that they may be attached to the sleepers of the track, and are thus held rigidly in position. They are pierced with 10 holes, so that several wires may be accommodated at once, and their positions varied if required. They fulfil the same purpose as the points rod guides and signal wire posts used in actual railway practice.

In connection with wiring-up there are two interesting mechanisms to be noted. The first of these is the Rodding Compensator, the function of which is to enable a pull given to a signal or points wire to be changed into a push, or vice versa. The necessity for this is dependent upon the position of the signals or points relative to the Lever Frame, and also the way in which either happens to be facing. The device consists essentially of two special cranks, connected by a link and pivoted on a base plate that is made to clamp to the rails. A fine range of positions is given for these cranks, for the sleeper pattern base plate has five possible holes for each crank to be mounted in. Similar devices are in use in actual practice, and a keen observer will see many of them alongside the line where the point rodding runs.



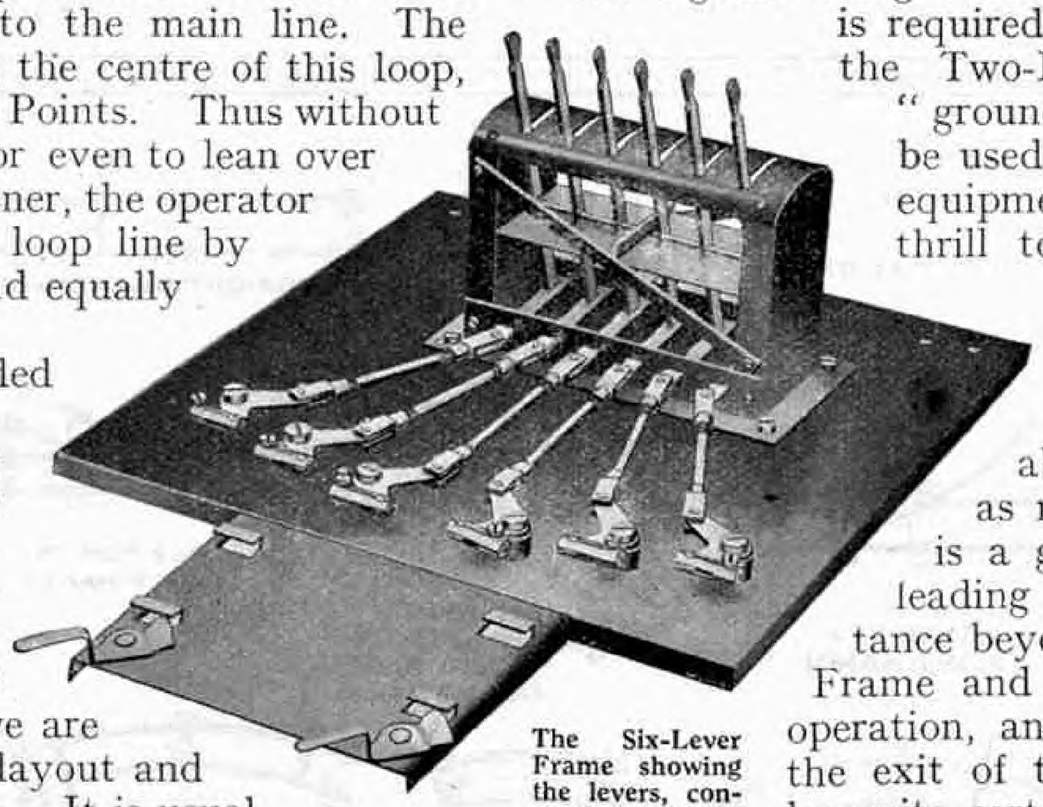
A Hornby "Distant" Signal fitted for Control Working. The bell crank and coupling at the base of the post enable connection to be effected with the Lever Frame.

The second mechanism is the latest feature of the Hornby Control System, and has only been introduced this season. This is known as the Rodding Traverse device. Its function, as suggested by its name, is to carry the control wire from one side of the track to the other. It therefore allows us to have the Lever Frame on the side of the track where it may be most convenient for handling, while the signals or points to be controlled may be on the opposite side. This is a very valuable feature, and immediately doubles the possibilities offered by the installation of the System.

Hornby Control System components are now available in three different assortments, No. 1, No. 2 and No. 3. These contain a Two, a Four and a Six-Lever Frame respectively, and a corresponding number of Control-fitted points, signals and accessories. Assortment No. 1 contains the Two-Lever Frame, and two Points are provided. The

use of these will allow a loop line to be added to a layout in the manner described in the Junior Section pages recently, and yet there is no need for the operator to be at either end of the loop to admit a train into it or to allow it to pass on to the main line. The Lever Frame may be placed at the centre of this loop, each lever controlling one of the Points. Thus without having to take a single step, or even to lean over the railway in an awkward manner, the operator may divert the train into a loop line by means of the facing points, and equally easily let it pass out.

Further possibilities are afforded to the owner of Assortment No. 2. Two Points are provided as before but in addition there are two Signals also. To provide the necessary control for this the Four-Lever Frame is included. The points may be used as before if desired, but we are now able to add signals to the layout and to operate them from a distance. It is usual to include one "home" Signal and one "distant" Signal, but two of either kind may be obtained if specially required. A Rodding Traverse is included in this Assortment, so that one of the signals may be placed on the opposite side of the line, as will be necessary if the signals are to be used for trains in opposite directions.

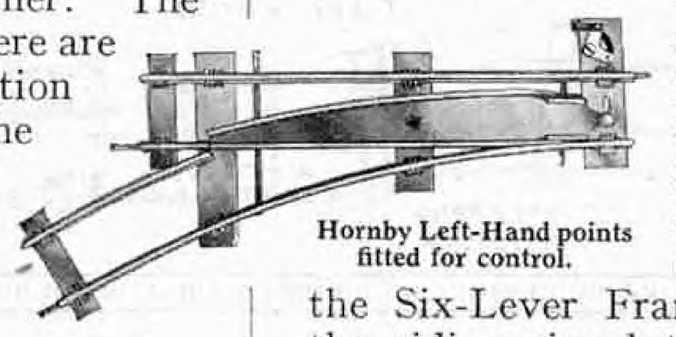


The Six-Lever Frame showing the levers, connecting rods and bell cranks.

Assortment No. 3 is more elaborate altogether. The largest or Six-Lever Frame is provided, and there are two Points, two single Signals and a Junction Signal fitted for control. With this outfit the loop may be laid as before, the entrance to it being governed in the correct manner by the Junction Signal, the use of which before the Points indicates the choice of roads that is possible. The "distant" Signal may be installed a suitable distance before the Junction Signal, while the "home" Signal may be used at the other end of the loop. Considerable work thus devolves upon the signalman, but as it is not necessary for him to move from his position his control is made much easier than if the Signals and Points were separately hand-operated.

All the Control components contained in the three Assortments may also be obtained separately.

Now let us see how the Control System works in actual practice. Let us assume that it is decided to install on a single line railway a small halt. Station The "M" Series Wayside may well be used for this purpose, as it is representative of the small "platform" halting places that are found in remote or thinly-peopled districts. The next step will be to provide a small dead-end siding for goods traffic, and the appropriate signals. A Four-Lever Frame will probably be necessary, and Points for the siding. "Home" signals for both directions, and the "home starter" for the siding, will employ the Four-Lever Frame to capacity. If the equipment generally is on a simpler scale and no siding is required, the station being merely a "conditional" halt, a "home" signal for each direction will be sufficient, the signals being used to indicate whether the train is required to stop or not. In this case the Two-Lever Frame arranged as a "ground-frame" without a cabin may be used. This is the simplest possible equipment, yet it provides a distinct thrill to be able to control the two signals from the one place.

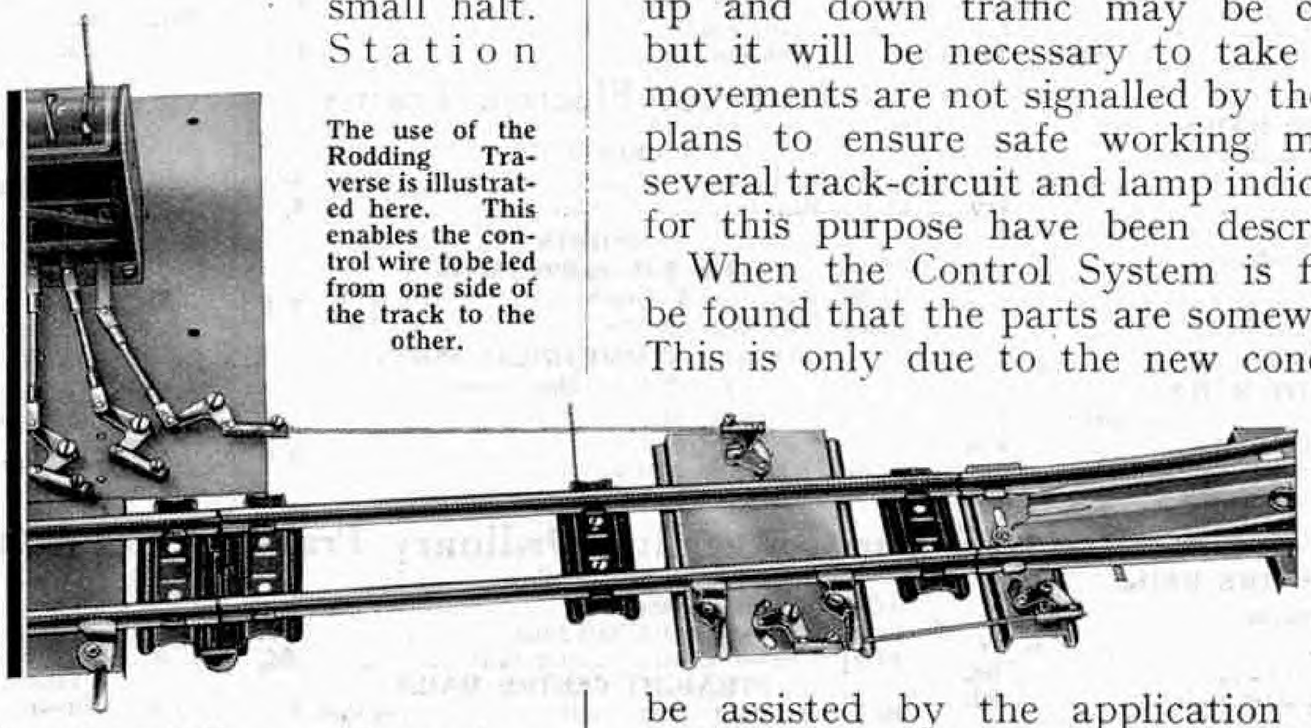


Hornby Left-Hand points fitted for control.

The Six-Lever Frame is specially useful where there is only one operator, for the ability to control from one place as many as six signals and points is a great advantage. The points leading to a siding may be some distance beyond the station where the Lever Frame and Cabin are installed, yet their operation, and that of the signal governing the exit of the train from the siding, will be quite certain and smooth. Many single line continuous miniature railways are operated in one direction only, chiefly for convenience in winding the engine facing one way. The signals of a typical station would be the "distant," the "home," and the "starter." The Signal Cabin might then be placed between the "starter" and the trailing points of the siding. Beyond the points would be the "advanced starter," by which trains requiring to stop before backing into the siding are halted; and in the siding would be the "home" signal controlling the exit of trains from the siding. Complete control of all these would be afforded from the Six-Lever Frame, the Rodding Traverse allowing the siding signal to be reached across the main line.

A large terminus or junction station requires fairly extensive equipment owing to the large number of points and signals usually found in such situations. Probably two Six-Lever Frames will be necessary, the signals and points controlled being divided between them in the most convenient manner for wiring up and operation. This dual control may be considered awkward, but there are usually more than one operator on a layout on which a really large station is installed, and the Frames therefore may be placed on opposite sides of the line if more convenient. In this way up and down traffic may be controlled separately, but it will be necessary to take care that conflicting movements are not signalled by the operators. Various plans to ensure safe working may be adopted and several track-circuit and lamp indication devices suitable for this purpose have been described in the "*M.M.*"

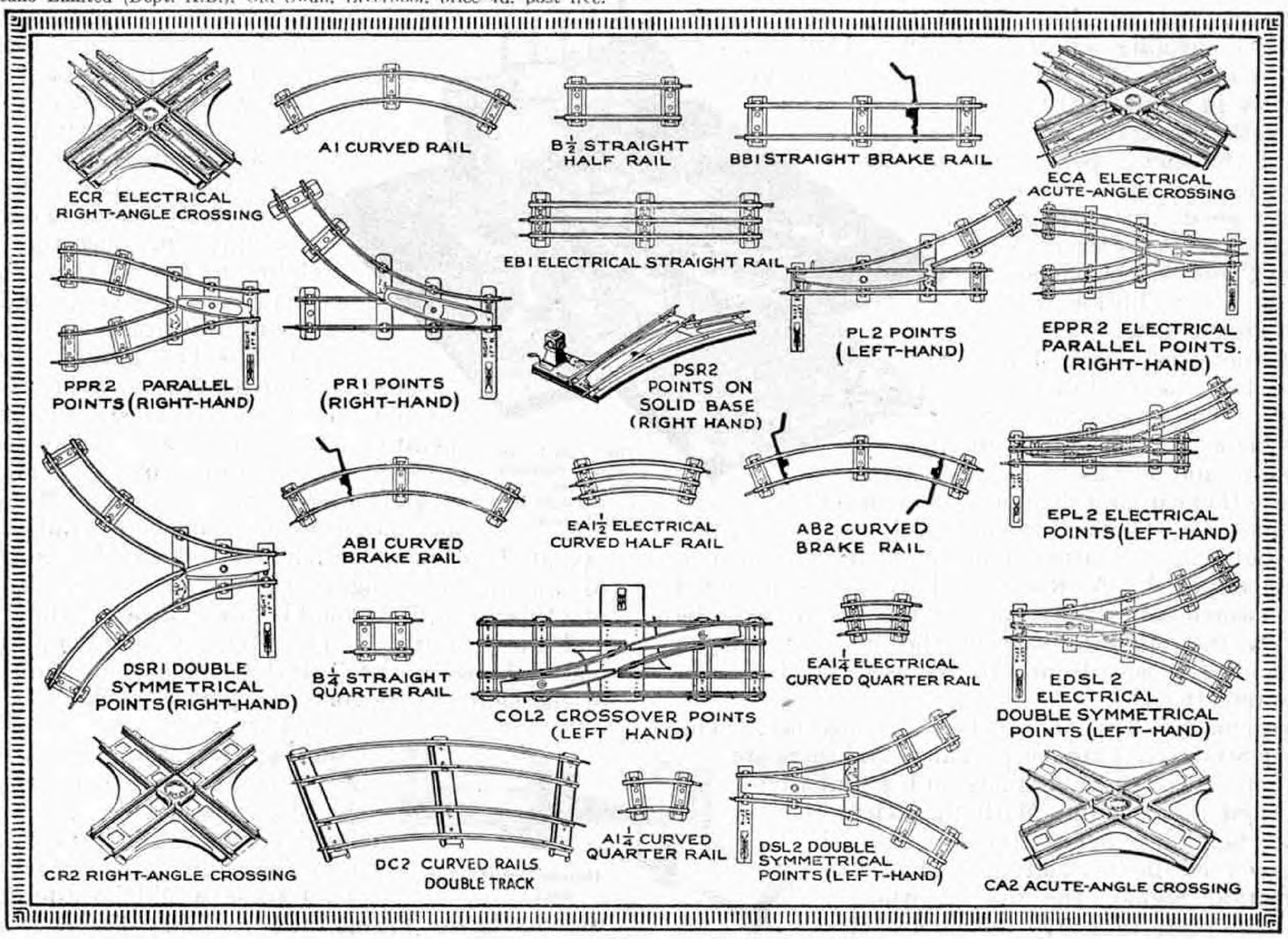
When the Control System is first installed it may be found that the parts are somewhat stiff in operation. This is only due to the new condition of the various components. Like all mechanical devices, they become "worked in" after a period of service, and this process may be assisted by the application of a little Meccano Lubricating Oil in order to make the various levers and cranks work smoothly and easily.



The use of the Rodding Traverse is illustrated here. This enables the control wire to be led from one side of the track to the other.

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet " How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Old Swan, Liverpool, price 4d. post free.



Alternate Pegs

CURVED RAILS

9-in. radius (For MO Trains)

M9	Curved rails	doz.	3/–
MB9	Curved brake rails	each	3½d.

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for MO Trains)	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.

Rails for Clockwork and Steam Trains

BBR1	Straight brake and reverse rails	each	1/6
DS1	Straight rails, double track ...	½ doz.	6/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right-hand	per pair	5/–
DSL1	Double symmetrical points, left-hand		

For 2-ft. radius curves

DSR2	Double symmetrical points, right-hand	per pair	5/–
DSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair	5/–
PPL2	Parallel points, left-hand		

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9

Gauge 0, 1¼″

CR1	Right-angle crossings (for 1-ft. radius tracks)	each	2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair	12/–
COL2	Crossover points, left-hand		

POINTS

9-in. radius (For MO Trains)

MR9	Right-hand points	per pair	3/–
ML9	Left-hand points		

1-ft. radius

PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		

2-ft. radius

PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		
RCP	Rail connecting plates ...	½ doz.	2d.

Rails for Electric Trains

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/–

2-ft. radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/–
EDC2	Curved rails, double track ...	½ doz.	9/–

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

ECA	Acute-angle crossings ...	each	4/–
ECR	Right-angle crossings	„	4/–

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

For 2-ft. radius curves

EPPR2	Parallel points, right-hand...	per pair	8/6
EPPL2	Parallel points, left-hand ...		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/–
ECOL2	Crossover points, left-hand		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied.

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. radius

AC1	Curved centre rails ...	per doz.	1/–
AC1½	Curved centre half rails ...	„	9d.
AC1¼	Curved centre quarter rails ...	„	6d.

2-ft. radius

AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.

STRAIGHT CENTRE RAILS

BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	per doz.	9d.
BC¼	Straight centre quarter rails ...	„	6d.
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

ILLUMINATION OF LAMP STANDARDS.—Lamp Standards are among the most effective of the accessories that add to the realism of a miniature goods yard, or of any scene near a railway station, but the impression they make is greatly enhanced when they are genuinely used for lighting purposes. Electrical Lamp Standards are now included in the Hornby Series, in which they are extremely popular, but those possessing the earlier pattern may readily adapt them to serve the same end.

The bulb required for this purpose may be used alone or in conjunction with the Bulb Holder, which is a standard Meccano part. The end of a wire is soldered to the metal side of the bulb or Bulb Holder, or is twisted tightly round it. A second wire is soldered to the small piece of metal at the bottom of the bulb, this being separated from the metal side by an insulator, of course. If the Bulb Holder is used, the second wire is fixed by means of nuts to the 6 B.A. bolt passing through the centre of the Bulb Holder. The wires are then passed through the glass bulb on the Lamp Standard and down the standard itself to the terminals of a flashlamp battery. A switch is inserted in one of the wires.

The type of bulb used in flashlamps has a flat globe and this enables it to be fitted inside the globe of the Lamp Standard. When the connections are satisfactorily made, therefore, the bulb is pulled up into its correct position by means of the wiring. The splendid effect of a series of illuminated Lamp Standards on a Hornby layout is amply sufficient to repay the slight amount of trouble involved in making this addition.

All the necessary parts may be obtained from any dealer, or direct from Meccano Limited. The Bulb Holders cost 3d. each, the 6 B.A. bolts are sold at 6d. per dozen and the price of the 6 B.A. nuts is 3d. per dozen.

CONVERTING CLOCKWORK RAILS FOR ELECTRIC WORKING.—In the past we have had large numbers of enquiries in regard to the conversion of Hornby Clockwork Rails for electric working, and in response to the demand that clearly existed we introduced Centre Rails, Clips and Insulators for this purpose. It should be noted that the sleepers of rails to be converted must be of the latest pattern, for these have two central slots that are designed for the reception of the Clips.

There is no difficulty in making the conversion. A Clip is first pushed from underneath through the slots of each sleeper. An Insulator is then fixed in each Clip, after which the Centre Rail may be placed in position. Care must be taken not to displace or damage the Insulator, of course. The Clips are tightened down on the Insulators by means of a pair of pliers, and the rail is then ready for testing. This should be carried out as described in each of the Hornby Electric Locomotive instruction leaflets.

It is a good plan to have a length of ready-made up electric rail at hand in order to serve as a guide during assembly. The Centre Rails are 1/– per dozen, the Clips 6d. per dozen and the Insulators 3d. per dozen, and they may be obtained in the usual manner through dealers or direct from Meccano Limited.



Visitors to an Exhibition keenly interested in operations on a Hornby Train layout. The running of miniature trains always exercises the greatest fascination, and as our photograph shows, enthusiasm is shared by young and old.

MINIATURE BUILDINGS.—We are interested in your idea that miniature buildings such as factories, farms, houses, etc., should be manufactured. Although we believe that their introduction would prove popular, we think that most model railway enthusiasts prefer to build accessories of this kind in their own homes to suit the conditions on their own layouts. (*Reply to T. F. Thompson, Newcastle-on-Tyne*).

FIELD HOARDINGS.—Features of this kind are well known to all railway travellers. We doubt if reproductions in miniature would appeal to Hornby Railway enthusiasts, however, as the space available in the majority of cases does not warrant the inclusion of fields in the surroundings of a layout. If specially required, the recently-introduced Station Hoardings, price 8d. each, could be used as field hoardings. (*Reply to L. Fox, Blackpool*).

HIGHER PLATFORMS FOR HORNBY STATIONS.—We note your criticism of the heights of the various platforms in the Hornby Series and agree that extra height would be an advantage. The present design leaves a good deal of space between the footboards of the coaches and platform level. The position will be carefully considered when our range of stations and platforms is revised. (*Reply to D. Harris, Boscombe*).

MINIATURE PASSENGERS.—The production of strips of paper, on which are representations of passengers, to fit inside Hornby Pullman and Saloon Coaches is an interesting suggestion and will be borne in mind. As you point out, the trains would certainly have more life in them than at present! We hope shortly to be able to make an announcement in regard to miniature platform figures. (*Reply to F. Kenshaw, Rugby*).

ADDITIONS TO THE HORNBY CONTROL SYSTEM.—We are interested in your suggestion that further accessories should be added to the present Hornby Control System. We have already introduced a device for the purpose of carrying the control wire from one side of the track to the other. It is known as the "Rodding Traverse," and may be obtained from any Hornby Train dealer price 1/6. A revised edition of the Hornby Control System Leaflet also is now available. This will be sent to any model railway enthusiast who applies to Meccano Ltd., Binns Road, Liverpool. (*Reply to F. Taylor, Bedford*).

MINIATURE SCENERY.—We have frequently explained to correspondents that miniature scenery is best made at home to suit the conditions obtaining on the enthusiast's own layout. Articles describing how to make suitable scenery have often been included in the Hornby Railway Company pages. The most recent of these appeared on page 240 of the "*M.M.*" for last March, and we suggest that you follow the advice given there. (*Reply to F. Bolton, Leicester*).

NEW DESIGN FOR NO. 1 PASSENGER COACH. — We agree that the 4-wheeled passenger coach is now practically obsolete in British railway practice, although a few vehicles of this kind have been constructed comparatively recently for special duties. Your suggestion regarding the withdrawal of the No. 1 Passenger Coach is scarcely reasonable, however. It is in great demand and we are considering a new design. If introduced we are sure that this will attract the more seasoned enthusiasts. (*Reply to A. Martin, Huddersfield*).

AUXILIARY TENDER MECHANISMS.—To introduce a tender equipped with a motor certainly would increase the hauling power of Hornby locomotives. A motor that could be fitted into the limited space available in the tender probably would run down long before that of the engine, however, and would have a severe braking effect on the whole train. Although the idea is interesting, it cannot be given consideration. (*Reply to R. Weston, Bristol, B. Mercer, Lincoln, and others*).

LINESIDE FEATURES.—We do not quite understand what you mean when you suggest that miniature lineside features should be introduced into the Hornby System. Gradient posts, mile posts, etc., have been available for some time. They form Railway Accessories Sets Nos. 5, 8 and 9. Illustrations of these sets appear in the Hornby Train catalogue, a copy of which may be obtained from any Hornby Train dealer or on application to Meccano Limited. (*Reply to R. Dodsworth, London, E.11*).

CRANK PATTERN WINDING KEY.—We have previously experimented with a winding key similar to the pattern you propose, but the results obtained were not satisfactory. The present pattern gives a double purchase in turning the spindle, and its handle also proves a very useful rail-gauge. Probably with a cranked key the wear of the spindle and of the mechanism side plates would be increased owing to the one-sided force exerted when winding up. (*Reply to J. Boote, Wallasey*).

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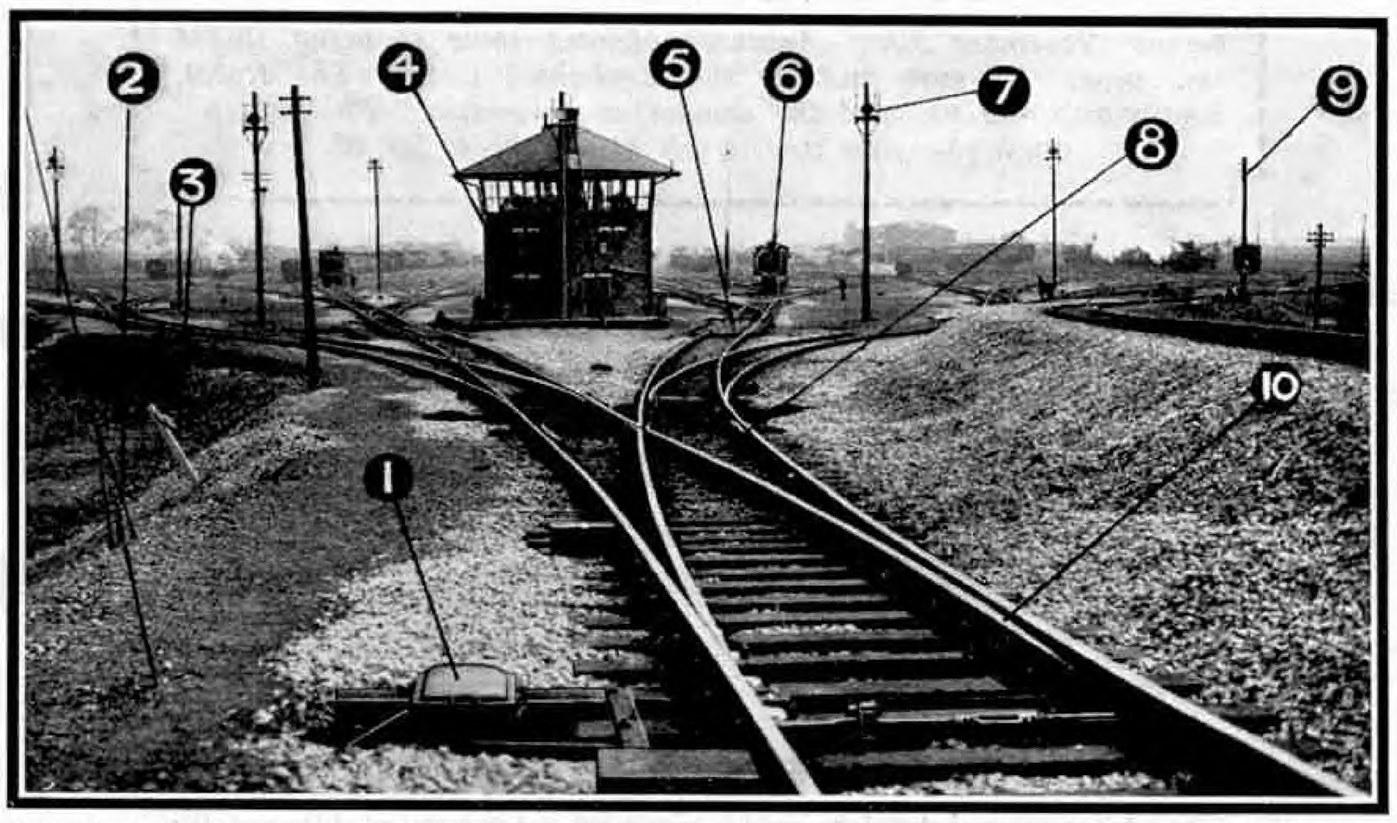
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H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

MARSHALLING YARD CONTEST

There must be very few members of the Hornby Railway Company who have not spent many enjoyable hours in railway goods yards, taking note of the types of locomotives employed and of the variety of rolling stock that is being shunted. The work of sorting out wagons in order to remarshal them according to their destinations is very fascinating to a railway enthusiast, whether it is carried out on a small scale in an ordinary yard, or in a more important depot where thousands of wagons are dealt with daily. In small yards the shunting is done throughout by means of engine power. In large modern yards the wagons are pushed over a low eminence, called a "hump," and run down by their own weight into the sidings, each in turn being switched into its correct road.



Can you name the features marked by numbers on the above photograph of the Whitemoor Marshalling Yard of the L.N.E.R.?

Many recently-planned shunting yards are of special interest because of their remarkable automatic equipment. The most remarkable example in this country is the L.N.E.R. marshalling yard at Whitemoor, near March. So efficient in action is this yard that no less than 69 trains, comprising 3,485 wagons, and requiring 2,166 uncoupling movements, have been shunted in 24 hours. A photograph of the yard is reproduced on this page, and for our contest this month we invite readers to identify those items of the equipment that in our illustration are indicated by means of a number. In addition to naming the items competitors must state their purpose. This should be done as briefly as possible, long and detailed descriptions being unnecessary.

The competition will be divided into the usual sections—Home and Overseas. To the senders of the four best entries submitted in each section, prizes consisting of Hornby Train material (or Meccano goods, if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In addition, a number of consolation prizes will be given.

Envelopes containing entries must be clearly marked H.R.C. "Marshalling Yard Contest" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, not later than 30th November. The closing date for the Overseas Section is 29th February, 1932. Each competitor must state his H.R.C. number, and failure to do this will lead to disqualification.

Voting Contest

As the model railway "season" comes round each year Hornby Train owners watch eagerly for the fresh items that are included in the System. These introductions are developed from suggestions that we have received from readers, and their widespread appeal to Hornby Train owners is therefore assured. The present year has been specially productive of new ideas, and we are interested to know which of these is the most popular among Hornby Railway owners.

With the object of ascertaining this we announce this month a Voting Contest in which each entrant is required to state:—

A. The item he likes best of all.
B. His idea of the order of popularity of the items as decided by the massed vote of all the competitors.

Competitors need not place their own favourite item at the head of list B, unless they believe that it will prove to be the choice of the other competitors. They should place it in the position in which they anticipate it will be placed by the massed vote.

The entrant's name, address and H.R.C. number must be added at the end of the list, which should be addressed H.R.C. "November Voting Contest," Meccano Ltd., Binns Road, Old Swan, Liverpool.

We give below a list of the recent additions to the Hornby System. Illustrations of these will be found in the advertisement pages of this and the two previous issues of the *"M.M."* Banana Van. Wagons:—Barrel, Coal, Fibre, Open "B" and "Mobiloil" Tank. Mitropa Coaches Nos. 0 and 3; M3 Tank Locomotive; "M" type Telegraph Pole No. 2; "M" Loading Gauge and "M" Level Crossing. Electrical Level Crossing No. 1; Electrical Lamp Standards Nos. 1 and 2; Electrical Crossover Points; Station Hoarding and Modelled Miniatures No. 1—Railway Staff.

Prizes of Hornby Train or Meccano products, to be chosen by the winners, to the value of 15/–, 10/6, 5/– and 2/6 respectively, will be awarded to the four competitors whose lists most accurately forecast the final result. In addition a number of copies of *"Famous Trains"* will be awarded.

The closing date of the Home Section is 30th November, and of the Overseas Section, 29th February, 1932.

COMPETITION RESULTS

HOME

August "Photo Voting" Contest. First: L. W. Steer (21673), Stoke-on-Trent, Staffs. Second: D. E. Weller (11085), Cobham, Surrey. Third: N. Carleton-Stiff (24661), Chudleigh, S. Devon. Fourth: D. M. Gilbert (19038), Hull.

August "Summer Photo" Contest. First: F. H. Braithwaite (14869), Guildford, Surrey. Second: W. Robb (23368), Comber, Belfast. Third: G. M. Lane (11170), Wakefield, Yorks. Fourth: G. Y. Tomlinson (10196), Thornton-le-Fylde, Lancs.

September "Hidden Stations" Contest. First: D. Felstead (19232), Wood Green, London, N.22. Second: N. R. Ward (7337), Stradbroke, Suffolk. Third: K. N. Beales (14024), Forest Hill, London, S.E.23. Fourth: K. A. Gee (17644), Bridlington, Yorks.

OVERSEAS

May "Third Name and Number" Contest. First: G. Hallack (17578), Cape Town, S. Africa. Second: J. A. Rodriguez (3647), Montreal, Canada. Third: R. A. Wragg (7913), Bandikui, India. Fourth: J. G. Gnanadurai (1964), Trichinopoly, S. India.

May "Electric" Contest. First: T. C. Walker (23864), Westmount, Canada. Second: R. S. Mansfield (10476), Sydney, Australia. Third: J. A. Coates (23863), Verdun, Quebec, Canada. Fourth: J. Hers (8270), Potchefstroom, S. Africa. Consolation Prizes: D. Matthews (16420), Cape Town, S. Africa; A. G. Saunders (9822), Hamilton, New Zealand; A. Johnstone (16298), N.S.W., Australia.

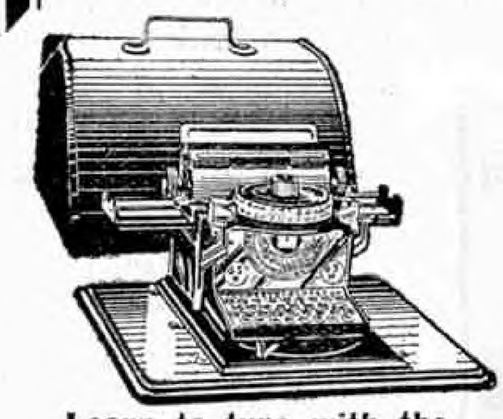
May "Electric Locomotive Drawing" Contest. First: D. Adams (17401), Sydney, Australia. Second: P. Galdes (14183), Valletta, Malta. Third: A. C. Davies (23637), Darlington, Western Australia. Fourth: S. Lindsay (23715), Randwick, Sydney, Australia.

BOYS!—Here's Another Page of Good Things From Your Favourite Store—

GAMAGES-HOLBORN

GAMAGES GREAT XMAS BAZAAR

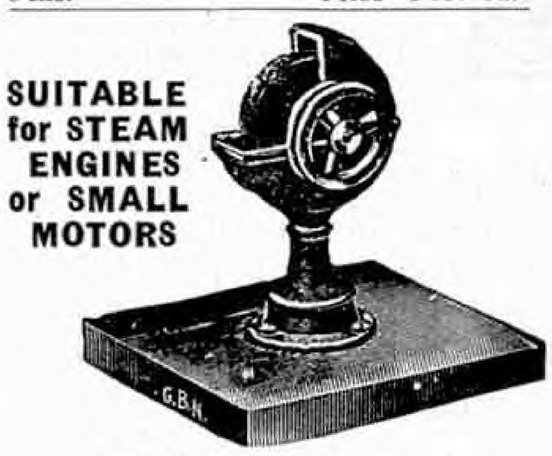
begins November 9th. Another splendid show is being staged this year. Be sure and see the Enchanted Castle, The Robot, Chapman's Circus, and the wonderful automatic "Photoweigh" machine—your correct wei ht and photo for 2d.



Learn to type with the

Junior Typewriter

Affords keen delight and valuable instruction. Fitted with metal type (not rubber) and bell stop. Complete with ribbon, this easily worked machine prints clearly 68 characters. Full alphabet (capitals and small letters), figures, stops. Paper 3¾ ins. wide, any length. Strongly constructed and finished in japanned metal with attractive red metal base and cover. Size 9 ins. × 8 ins. × 5 ins. Price **10/6** Post 6d.

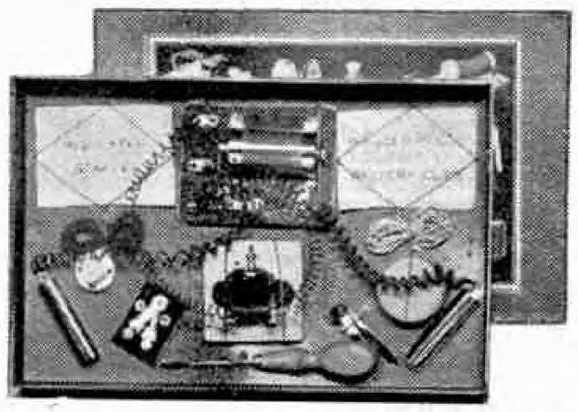


SUITABLE for STEAM ENGINES or SMALL MOTORS

GRINDSTONE

In cast metal with trough. Enamel finish. Size 4 ins. high × 3½ ins. long. Post 6d. **2/6**

Superior quality, 5½ ins. high. Post 6d. **3/6**



ELECTRIC OUTFITS

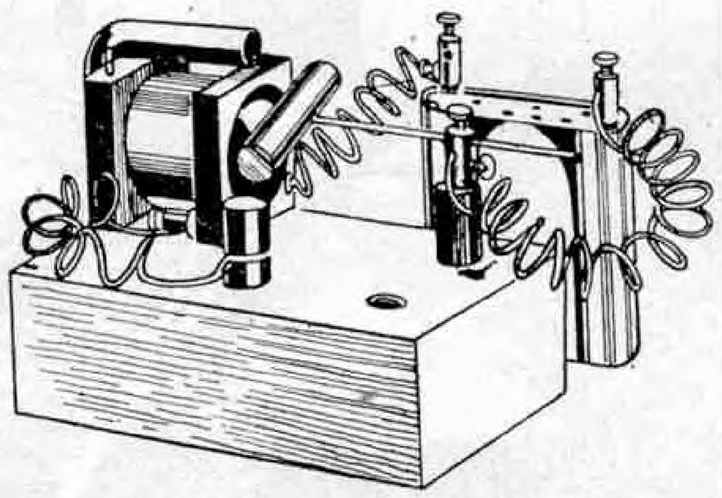
No. 0. Consisting of 4 Lamps, 4 Porcelain Holders, 2 Shades, 2-Way Switch, 1 Key Switch, Flex Staples, etc., with directions. **3/6.** Post 6d.

No. 2. Medical Coil and Lighting Outfit with instructions. **7/6.** Post 9d.

No. 3. As illustrated. Comprises 1 Motor, 1 Medical Coil, 1 Lamp, 1 Porcelain Lamp Holder, Insulating Tape, 2-Way Switch, Battery Tester, Screwdriver, Wander Plugs, Flex, Staples, etc. Post 9d. **10/6**

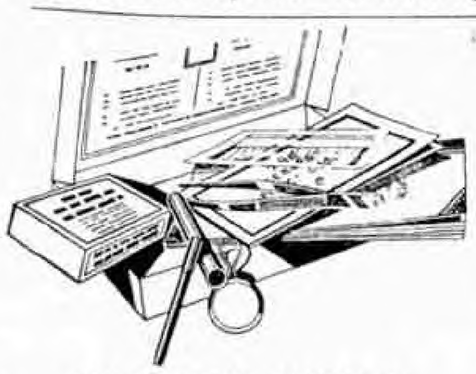
THE FARADAY SERIES OF GAMES BOXES

These Games boxes teach in an hour knowledge that is useful throughout a lifetime. They demonstrate science in its simplest form. Each Experiment is complete in itself and fully reveals "cause and effect." There is no mess, and every experiment is fool-proof and safe. Send for Catalogue.



The FARADAY "ELECTROTECHNIC" BOX

The whole science of electricity can be expounded and demonstrated through the 398 experiments which this box enables you to carry out. Magnetism, Electric Charges, Galvanoscope, Morse Telegraph, Electric, Electric Light, Magnetic Induction, Telephone, Microphone, Electrolysis, Wireless, Telegraphy, Electric Motors, etc. Wonderfully illustrated book of instructions. **37/6**



GAMAGES JUNIOR STAMP COLLECTOR'S OUTFIT

An ideal set for the junior stamp collector.

CONTENTS :

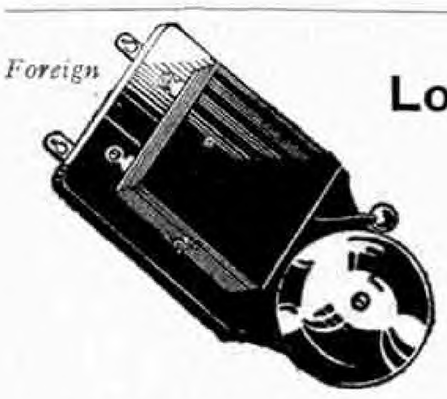
(1) 200 Foreign Stamps.
(2) 1,000 Stamp Hinges, Super-Peelable.
(3) Duplicate Case.
(4) "Guide to Stamp Collecting."
(5) Mount Damper.
(6) Magnifying Glass.
(7) Transparent Perforation Gauge.
(8) Rustless Tweezers.

Price **5/-** Post 4d.



The biggest value in fountain pens ever offered. We have sold thousands of these pens. They are ideal for office, home or school use. 14 ct. gold nib, gilt clip. Lever filled, fitted with unleakable safety cap. Only obtainable at Gamages.

Price each **2/6** Post 2d.



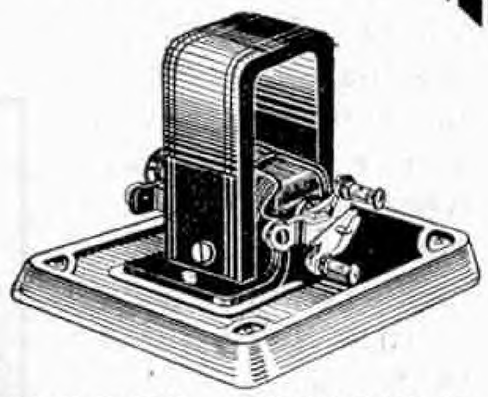
Foreign

Wonderful Value!

Loud Gong Electric Bells

Very strongly made. Length 7 ins. Width 4 ins. Gong 2¾ ins. Gamages price only **2/-** Post 4d.

We stock all Hornby Train and Meccano Parts and can give prompt delivery to all parts of Britain.



MODEL DYNAMO

4,000 R.P.M. Suitable for use with model steam engines. Capacity about 3.5 volts ¼ amp. 2⅜ ins. high. Will light one miniature lamp. Price **8/9** Post 6d.



Great Demand for Gamages

New Model Aeroplane

Only 4/6

Introduced to "Meccano Magazine" readers last month, this new model aeroplane is selling quickly. It is really wonderful value. Beautifully constructed and strongly built, an excellent flyer. Can be launched in the air or will rise up from the ground. Wing span 23 ins. Length 27 ins. Compare the value. Price **4/6** Post 6d.



"UBILDA" SALOON

The parts are packed as illustrated. When built up the car proves to be very strong and rigid and brilliantly decorated in bright colours.

Fitted for electric lights—Two Lamps—No Battery.

A CONSTRUCTIONAL TOY AND A MECHANICAL TOY IN ONE.

Size of "Ubilda" Saloon in parts is 9 ins. by 9 ins. by 2 ins. Length of "Ubilda" Saloon built is 9 ins. (Made in England). Price **3/6** Post free.

GAMAGES, HOLBORN, LONDON, E.C.1

Telephone: Holborn 8484. *City Branch: 107, Cheapside, E.C.2*

Competition Page

MISSING WORDS No. 2

When we introduced the Missing Words Contest in our issue for May last we anticipated that it would prove popular, for our readers have always shown a marked partiality for competitions involving word construction. We could not foresee that it would prove the most popular "Word" Contest—not even excluding Crossword Puzzles—that we have ever held. The number of entries greatly exceeded that in any previous contest announced in the *"M.M."* however, and the popularity of the new form of competition was equally marked in both the Home and Overseas sections.

There have been many requests for another contest of the same type and we are glad to comply. In the panel in the centre of this page there is what we might term the skeleton of a news paragraph of interest to all Meccano boys. Certain words, 21 in number, indicated by dashes have been removed from the paragraph and arranged at the foot of the panel in alphabetical order. The test is to replace the 21 words in their correct positions. Every one of the listed words is used in the original, but only as frequently as it appears in the list.

When all the words have been replaced the paragraph should be written out carefully, with the missing words inserted to form the complete solution.

The competition will be divided into the usual two sections—Home and Overseas—and in each prizes of Meccano or Hornby Train products (to be chosen by the winners from our current catalogues) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four most nearly correct solutions in order of merit. A number of consolation prizes also will be awarded. In the event of a tie for any or all of the prizes, the judges will take into consideration the neatness of the entry or its novelty of presentation.

Competitors are reminded that they must write only on one side of each sheet of paper used for their entries, and that their names and addresses must appear on each separate sheet.

No competitor may submit more than one entry, and this must be addressed to "Missing Words No. 2, Meccano, Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 30th November. The closing date for competitors residing outside Great Britain and Ireland will be 29th February, 1932.

To-day Great Britain holds no fewer than three world's speed records, these having been made on land, on water and in the air. One of them is held by Sir Malcolm Campbell, who in his — car, the *"Blue Bird,"* covered a measured mile in two directions at an average speed of 245.736 m.p.h. On water, Kaye Don drove his — motor-boat, *"Miss England II"* at a — of 110 m.p.h. and thus — a record on water.

In each of these two cases the holder has established a good lead over his nearest —, but in the air it may almost be said that Great Britain has no —. The highest speed ever — by an — from any other country is 318 m.p.h., a record that was — in 1927 by Major Bernardi, the Italian —. This was first — by Flt. Lt. D'Arcy Greig later in the same year, but Major Bernardi's figures were not — by 5 m.p.h., and so the new record was not official. No — was made in 1929. In that year Sq. Ldr. Orlebar — a record when he — 355.8 m.p.h., and last September Flt. Lt. Stainforth created a sensation by travelling at the — of 379.05 m.p.h.

Owing to an — in timing it was at first — that Flt. Lt. Stainforth's speed was 386.1 m.p.h., but it is — that photographic timing of flights is more accurate. This record was — disappointing, and a further effort produced the — figure of 408.8 m.p.h.

airman	created	reached
amazing	error	remarkable
attained	established	rivals
beaten	made	speed
believed	mistake	surpassed
competitors	pilot	thought
considered	rate	wonderful

Crane Drawing Contest

It is a considerable time since an engineering subject was set for our Drawing Competitions and, as a young reader put it to us in a letter recently, "it is high time something was done about that." This month, then, readers are asked to draw a crane at work. Any type of crane is eligible, from a giant blocksetter down to a simple derrick, but it must be shown in action. Few boys will have difficulty in finding a crane of some kind in their immediate neighbourhood, but failing that, any one of the many crane illustrations that have appeared in the *"M.M."* may be employed as a guide. Naturally, all other things being equal in the judging, preference will be given to an original entry—one prepared from an actual crane rather than an illustration. Coloured or black and white drawings are equally eligible, of course.

The entries will be divided into two sections for judging, A for those from readers aged 16 and over, B for those from readers under 16; and prizes of Artist's Materials or Meccano products (as desired by the winners) to the value of 21/– and 10/6 respectively will be awarded to the best and second best entries in each section.

Competitors may enter more than one drawing if they wish, but each must bear on its back the competitor's name, age and address. It is not sufficient merely to indicate Section A or Section B. The age must be given. Entries should be addressed "Crane Drawing Competition, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 30th November. Overseas closing date, 29th February, 1932.

Readers who desire to have their entries returned are reminded that stamped addressed wrappers must be sent for the purpose with the entry. It is rarely possible to associate a wrapper with a drawing after receipt, for the process of judging involves several preliminary sortings of the entries.

COMPETITION RESULTS

HOME

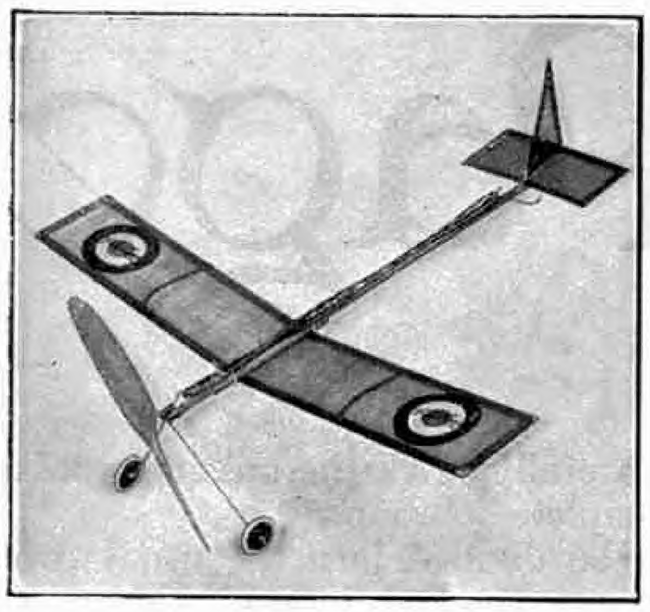
Third Stomachion Contest. 1. D. J. Young (Birmingham); 2. A. L. Ross (Wimbledon Park, S.W.19); 3. R. E. Roberts (Liverpool); 4. J. E. Broadhurst (Westcross, Glam.). Consolation Prizes: Wm. Deacon (Rhondda); D. Gall (Canterbury); S Heaton (Leicester); I. Hennell (Putney, S.W.15); A. Murray (Glasgow); J. D. Neaves (Enfield); L. Woolford (Bradford).

Triangles. 1. L. Wilcock (Sheffield); 2. J. Cables (London, S.E.13); 3. R. I. Sargeant (Boston); 4 L. J. Barnes (Aldbourne). Consolation Prizes C. Duckworth (Burnley); D. H. Innes (Hawick) D. King (Middlesbrough); S. G. Smith (Forest Gate, E.7).

OVERSEAS

Missing Words. 1. D. J. White (Dunedin, N.Z.); 2. D. Gordon (Victoria, Australia); 3. J. de S. Wallace (Lisbon); 4. K. J. Orams (Blenheim, N.Z.). Consolation Prizes: D. Atkinson (Yalwal, N.S.W.); A. Coldham (Peachland, B.C.); L. Fagg (Otago, N.Z.); H. Hamilton (Niue Island); W. L. Holcroft (East London, S. Africa); R. G. Hutton (Canterbury, N.Z.); N. Johnston (Dunedin, N.Z.); R. B. McMillan (Melbourne); M. W. Morten (Auckland); D. Sutherland (Westmount, Que.); Miss G. de Verteuil (Port-of-Spain); L. G. Williams (Victoria, Australia).

June Crossword Puzzle. 1. H. Mackay (Mrrinsville, N.Z.); 2. D. J. White (Dunedin, N.Z.); 3. MacL. Morgan (Cremorne, N.S.W.); 4. E. Harper (Cambridge, Cape Province).



HERE'S A WONDER LINE
The "NIPPER"
WARNEFORD of course!
Performance Counts—Not Size!

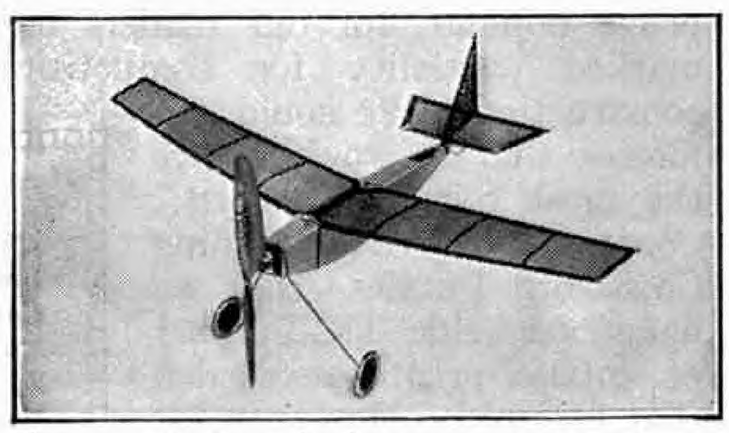
The "NIPPER"

Price 2/6

Special Features:

A long bearing allowing no movement or wobble on the propeller—therefore a steady flyer. High tension steel wire tail and rudder—therefore model can be adjusted for stunting. All aluminium wheels, fitted brass bearings, and the model has an amazing performance as the whole Aeroplane weighs less than one ounce. The finest machine ever produced at such a price.

FREE! All Warneford Models are capable of a duration of 30 secs. Any pilot who obtains this performance with a duly witnessed flight is entitled to the certificate and Blue and Gold Wings of the WARNEFORD JUNIOR AIR LEAGUE. An entry form and full particulars are enclosed with every Machine retailing from 4/6 upwards. New descriptive booklet post free on application.



The "WHIPPET" Fuselage Model Price 17/6

Fitted 11-in. hand-carved and balanced propeller, and covered orange proofed silk. This beautiful Fuselage Model Aeroplane has an excellent performance, is very strong, and has full adjustment of main-plane, tail and fin. It dismantles and folds so that it fits into a very small box for storage and transport, the finish is in keeping with the usual Warneford high standard, and at its price it is undoubtedly the finest value ever offered. Weight, 4⅜ ounces. Distance, 550 feet. Speed, 17 m.p.h. Ceiling, 50 feet. Rises from the ground.

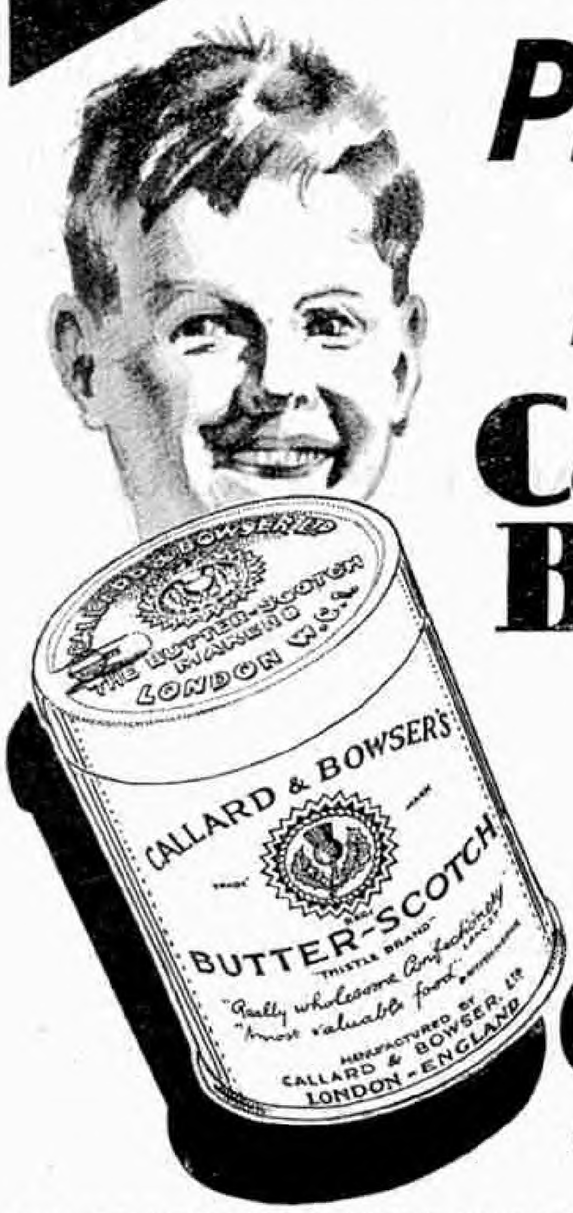
OTHER WARNEFORD MODELS FROM 1/6 TO 35/-

Warneford Aeroplanes are obtainable from all good Stores, Toy Shops and Sports Dealers throughout the country.

Sole Manufacturer:

F. J. MEE (Dept. C), 137a, GREENWICH ROAD, LONDON, S.E. 10

BUTTER-SCOTCH *Please!!*



but let it be

Callard & Bowser's

it's fine

Sold in the original paper packets at

1d. 2d. 6d. & 1/-

and in

6d & 1/-

round airtight tins

CALLARD & BOWSER LTD., DUKE'S ROAD, LONDON, W.C.1.

S.C.P. 114



A real 'man size' liquid pistol for 1/6

LOOKS just like a real automatic and shoots a strong jet of water about 25 feet. It is strongly made from metal with blued steel finish and there are no rubber parts to perish or wear out. It's a pistol that will last a lifetime.

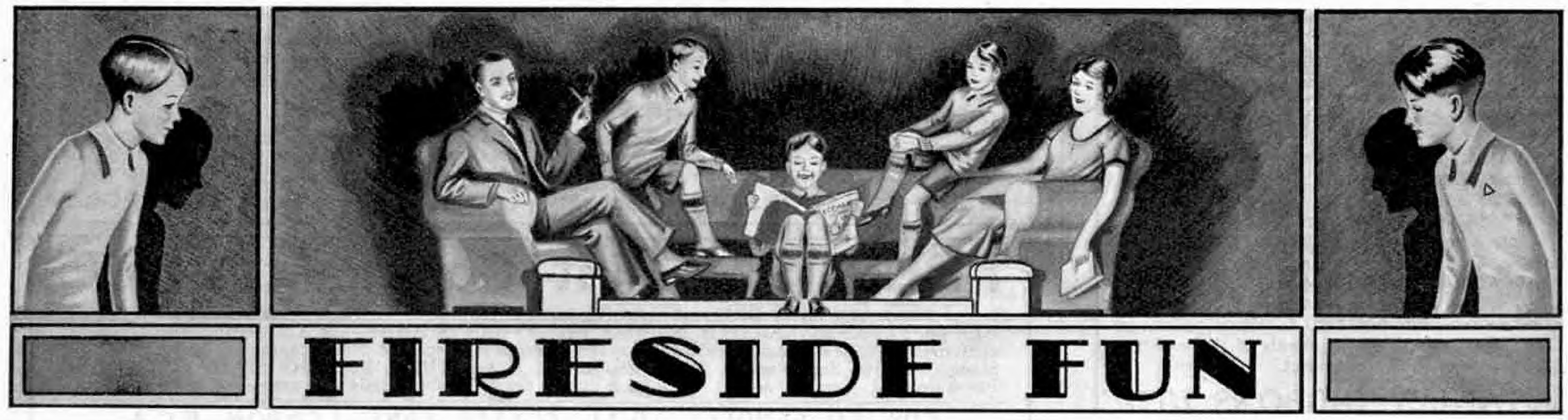
That's the pistol you should have—one that will really **do** something. Get one from your nearest dealer—only **1/6**—but be sure it's a DAISY as illustrated above.

A catalogue showing all DAISY Air Guns will be sent free on application.

DAISY
AIR RIFLES

(Made in U.S.A.)

Wm. E. Peck & Co. of London, Inc., 31, Bartholomew Close, London, E.C.1.



FIRESIDE FUN

A PITY TO LOSE IT

A man travelling in a wild part of South America went into a shop in the capital of a small state to buy a watch and chain. The watchmaker wrapped up the watch he had chosen, and included a revolver in the parcel.

"What are you doing?" observed the astonished traveller. "I didn't ask for a revolver."

"Why, you've bought a gold watch," said the watchmaker, "You ought to try to keep it!"

* * * *

Isaac and Solomon were dining together. Solomon helped himself to the larger fish on the dish brought them leaving the smaller one for Isaac.

"Fine manners you have, Solomon," said Isaac angrily. "If I had reached first I should have taken the smaller fish."

"Vell, vot are you complaining for?" asked Solomon. "You got it, didn't you?"

* * * *

"Don't give up hope. Somewhere above the clouds the sun is shining."

"That is all very well," said the victim of misfortune. "Somewhere below the ocean there's solid bottom, but that is no use to a man who falls overboard."

* * * *

Old Mrs. Watkins grumbled at everything and everybody, but one day the vicar thought he had found something about which she could not complain.

"How splendid your potatoes are this year," he said with a beaming smile. "You must be very pleased with them."

"They're not so poor," snorted the old lady. "But where are the little ones for the pigs?"

* * * *

"Say, Tom, what are yer striking for?"

"Shorter hours, Bill."

"Good! I'm with you. I always thought sixty minutes too long."

* * * *

"For three years I hadn't a shirt on my back," said the garrulous individual who was telling the story of his life in a Turkish prison camp.

"That's bad," said the bored listener. "However did you manage about a hole for your collar-stud?"

* * * *

Mother: "Poor little darling! How did you get hurt?"

Johnny: "Daddy told me to play on the piano and I fell off."

* * * *

"As I was going over the bridge the other day," said an Irishman, "I met Patsy O'Brien. 'O'Brien,' I says, 'how are you?'

'Pretty well, thank you, Brady,' says he.

'Brady?' says I: 'that's not my name.'

'Faith,' says he, 'and mine's not O'Brien!' With that we looked at each other, and bedad it was naythur of us!"

* * * *

A DISGRACE TO THE SERVICE



Old Lady (to airman who has crashed into tree): "You ought to be ashamed of yourself, going bird-nesting at your time of life."

* * * *

Mrs. Newbride: "Where's the paper plate I gave you under the pie?"

Mr. Newbride: "Was that a plate? I thought it was the bottom crust."

PAST EXPERIENCE NO GUIDE

A lady entering a grocer's shop brushed her coat against wet paint on the door.

"I've spoilt my coat on your door," she said angrily.

"I'm sorry!" apologised the grocer. "But the notice says 'fresh paint,' and it isn't my fault."

"That means nothing," answered the irate lady. "You have a notice that says 'Fresh eggs,' but they are not fresh."

* * * *

Artist: "Have you any objection to my painting your pretty little cottage to-morrow?"

Farmer: "Paint my cottage! Nay, lad, there's only old George in't village goin' to paint my house. He's done it now for nigh on 40 year."

* * * *

WILFUL NEGLIGENCE



Old Lady (to motorist who has mounted the pavement, crashed into a lamp post and ended up against a wall): "Well, of all the dangerous driving I've ever seen! Look what you've done. You've broken this poor little boy's hoop!"

* * * *

The pompous stranger strolled into the office and demanded to see the manager.

"I'm sorry he is not here," replied the clerk. "Is there anything I can do for you?"

"No," snapped the visitor, "I never deal with underlings. I'll wait until the manager returns."

"Very well, take a seat," said the clerk, and went on with his work.

About an hour later the man became impatient.

"How much longer do you think the manager will be?" he demanded.

"Nearly a fortnight," was the reply. "He went away on his holidays this week."

* * * *

"Have you got a piece of cake, lady, to give a poor man who hasn't had a bite for two days?" asked the tramp.

"Cake? Isn't bread good enough for you?"

"Usually, ma'am; but this is my birthday."

* * * *

An old farmer was complaining bitterly to the minister of the terribly bad weather for the crops, when the latter reminded him that he had much to be grateful for just the same.

"And remember," said the good man, "Providence cares for all. Even the birds of the air are fed each day."

"Aye," replied the farmer, darkly, "off my corn."

* * * *

Hungry Workman: "I feel like a good meal."

Very Hungry Workman: "I wish you were."

* * * *

A teacher was taking drill with a class of boys. The exercise was on deep breathing and concluded with advice on regular practice.

"Every night," exclaimed the teacher finally, "stand in front of an open window and throw your chest out."

* * * *

A Scotsman went to a Jewish friend's house, and on leaving took out sixpence and a penny, and showed them to his friend's son.

"Now, Isaac," he said, "which one will you have?"

"Vell," Isaac remarked at length, "I vill not be greedy. I vill have the little one."

"Well, Isaac," replied the delighted Scotsman, "for not being greedy I will give you the big one."

A BUDDING GENIUS

"I see you have labelled this blank page in your drawing book 'Pursuit of the Israelites across the Red Sea,' Smith," said James. "Where is the sea."

"That has rolled back to allow the Israelites to pass," replied Smith.

"But where are the Israelites, then?"

"They have just crossed," said Smith, "and their pursuers have not come up yet."

* * * *

"Listen!" said the teacher, "There is a saying that says 'Riches take unto themselves wings and fly away.' Now, what kind of riches does that mean?"

Only Johnny, who was seated at the back, raised his hand.

"Splendid, Johnny," said the teacher. "I am glad somebody knows. Now tell these stupid boys what kind of riches were meant."

"Please, mum," replied Johnny proudly, "Ostriches!"

* * * *

"Good morning, Mrs. 'Arrison!" said the milkman.

"My name is not Mrs. 'Arrison," replied the lady of the house haughtily.

"Ho! Isn't it? If a haitch, a hay, two hars, a hi, a hes, a ho and a hen don't spell 'Arrison, what does?"

* * * *

Long-Winded Lecturer: "If I have talked too long it's because there is no clock in this hall, and I have left my watch at home."

Voice from Audience: "There's a calendar behind you. That will suit you better."

* * * *

Tourist (in village store): "What have you got in the shape of motor car tyres?"

Smart Assistant: "Funeral wreaths, invalid cushions and doughnuts, sir."

* * * *

A negro mammy had a large family. They were all very well behaved, and one day her mistress commented on this.

"Sally, how do you raise your boys so well?" she asked.

"Ah'll tell you, missus," answered Sally. "Ah raise dem wid a barrel stave and Ah raise 'em frequently!"

* * * *

"Where did you get that awful cigar you gave me yesterday?"

"What do you mean by awful? That was two-for-a-shilling cigar."

"Well, then, who got the tenpenny one?"

* * * *

Judge: "What happened after the prisoner gave you the first blow?"

Witness: "He gave me a third one."

"You mean a second one?"

"No, I gave the second one."

* * * *

A QUESTION OF TIME



Voice from upstairs: "Henry, what time is it by the clock?"

Henry (who has been discovering how it works) "Just a minute, mother. I'll tell you as soon as I've put it together again."

* * * *

Bob: "Why is the roof of a house like midnight?"

Bill: "I'm sure I don't know."

Bob: "'Slate, my boy, isn't it?"

LOOK AT THESE SETS!

NYASSA. (S3547), 1921 Pictorials: Giraffe, da Gama, Zebra, Ship and Dhow, 18 un., 3/6. (S572), a shorter set of above, 16 un., 1/3. **NYASSA.** (S1576), Triangulars (Giraffe, Zebra, etc.), 9 un., 1/3. **LABUAN.** (S3841), 1894, Stag, Dyak, Palm, Pheasant, etc., 11 un., 5/–. **BORNEO.** (S3843), 1894, Similar Zoo Set, 11 un., 4/6, or (S3842), a shorter set, 9 un., 2/6.
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Chetwynd, Shanklin Drive, Westcliff-on-Sea

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EDWARD SANDELL, 10-11, FETTER LANE, LONDON, E.C.4

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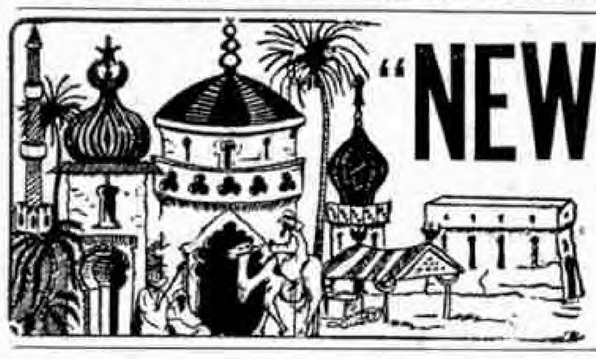
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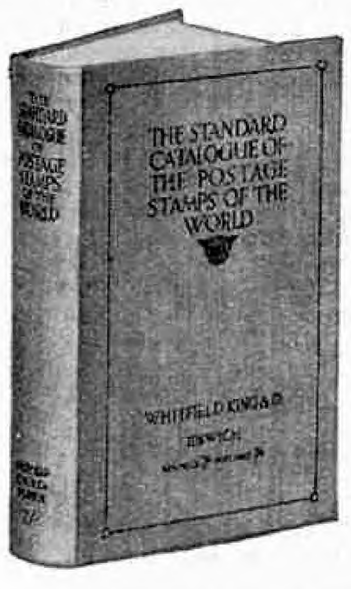
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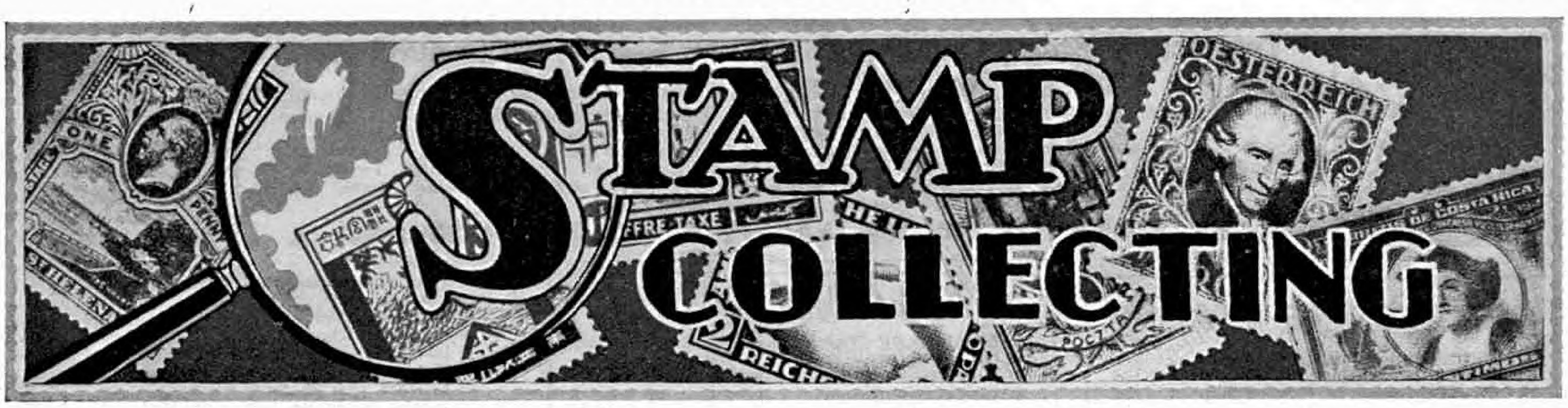
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A STAMP MOUNTAINEERING EXPEDITION

FEW sports are so full of thrills and so exclusively a matter for the physically fit as mountaineering, but as is the case with many another exclusive sport, only the favoured few can indulge their tastes. The stamp collector happily is provided with a substitute. The pages of his stamp album will take him, when and as his whim dictates, above the snow line of many of the world's most famous peaks. The Swiss Alps, the Canadian Rockies, the Andes, the Alpine beauties of New Zealand, the volcanoes of Iceland—all may be visited and climbed in the imagination.



Nearest at hand lie the Swiss Alps—favourite playground of the European mountaineer—mere hills when compared with the mighty peaks of the Himalayas and the Andes, but possessed of a charm and beauty that enthrals all who behold them. The Lyskamm, although one of the smallest peaks in point of height, its summit being only 4,538 ft. above sea level, yields nothing in beauty to any of the larger and better known mountains. Our illustration is of the 20c. Swiss *Pro Juventute* stamp of 1929, and shows the Lyskamm as viewed from Ryffelberg.

The rugged outline of Illimani, one of the mightiest peaks of the Andes, illustrated from the Bolivian 5c. issue of 1916, provides an interesting contrast to the graceful slopes of the Lyskamm. Illimani, 21,030 ft., is one of the highest of the Andean peaks. The Andes are the greatest physical feature of the South American continent, and run throughout the length of it, commencing in Panama and trailing off, like the scales of a dragon's tail, into isolated peaks reaching to Cape Horn. At its highest and widest section, in Bolivia, the system is as much as 500 miles in width, and the peaks frequently attain altitudes greater than 20,000 ft. Mount Potosi, another of the great Andean peaks, is pictured on the 1c. value of the same issue.

In the Central American zone, Nicaragua provides several interesting pieces of mountain scenery. The design of the earliest Nicaraguan stamps showed a portion of the volcanic Maribios range, but our illustration is of the 1c. stamp of the 1900 issue showing the volcano Momotombo.

This is truly a stamp with a story, for it played a large part in determining the location of the Panama Canal. When Nicaragua and Panama were advocating their respective claims before the U.S. Senate, the Nicaraguan supporters made great capital of the terrible earthquake menace at Panama, claiming that Nicaragua was comparatively immune from volcanic disturbances. They asserted that there had been no eruption since 1835, and that even then the Cosquina Mountain emitted smoke and ashes but no lava.

Philippe Banau Varilla, a brother of the French civil engineer who was associated with the canal operations for many years, and part proprietor of the famous French newspaper "*Le Matin*," at this juncture made an interesting discovery. He found that the 1900 issue of Nicaraguan stamps used as its design a view of the Momotombo Mountain pouring forth a great volume of smoke, and, in addition, an accurate picture in the foreground of the very dock that had been destroyed only a few days before by a volcanic eruption! Varilla searched every Washington stamp dealer's store and eventually secured sufficient copies of this stamp to supply every senator with definite evidence of the inaccuracy of the Nicaraguan statement. Three days later the American Senate passed a bill naming Panama as the location for the proposed canal.







Although Switzerland may claim the most beautiful mountain stamp, for sheer grandeur Canada's current $1 value, showing Mt. Edith Cavell, leaves nothing to be desired. Located in the famous Jasper National Park, a virgin territory 5,380 square miles in area, overlooking the Fraser River, Mt. Edith Cavell rises to 11,033 ft., but even then is overshadowed by the neighbouring Mt. Robson, the loftiest of all the peaks in the Canadian Rockies, which reaches an altitude of 13,068 ft. A particularly interesting feature of Mt. Edith Cavell is the remarkable shape of a glacier that clings to its side. In plan it so greatly resembles an angel with outspread wings that it has come to be known as "The Glacier of the Angel."



The Alpine climber will find all the sport he desires among the peaks of Jasper Park. Writing of Mount Robson in his book "*The Call of the Mountains*," Mr. Le Roy Jeffers says: "With no easy point of attack, Mt. Robson seems likely to remain one of the most difficult and alluring climbs which the mountains have to offer. Viewed as yet by a mere handful, this wilderness of snow and ice, of terrible precipices and sublime heights, holds much in keeping for all who seek the solitude and the companionship of the mountains that they may worship amid their eternal sanctuaries."

Those words might well have been written also of Mt. Cook, the giant of the New Zealand Southern Alps, that reaches 12,350 ft. at its highest point. Our illustration is taken from the ½d. stamp of New Zealand's 1898 issue, from which we also use the 1d. value showing an excellent picture of Mount Ruapehu, 9,175 ft., seen across Lake Taupo. Several other interesting mountain views are available in the same series, notably Pembroke Peak from Milford Sound, on the 2d. value; Mount Earnslaw and Lake Wakatipu, 2½d.; a further magnificent view of Mt. Ruapehu approached through the Otira Gorge on the 5d. stamp, and a second very striking picture of Mount Cook on the 5/– value.

Many of the most interesting mountains illustrated on stamps are volcanoes, and in addition to Mount Momotombo, to which we have already referred, we illustrate Mount Agua, the most famous of several volcanoes located in Guatemala. This is shown on Guatemala's air stamp issued in June, 1930. Mount Agua rises to a height of 13,108 ft. and derives its name, which means Water Mountain, from the fact that in 1541 it belched forth a great flood of water from its crater and completely destroyed the city of Old Guatemala.

In the space at our disposal it is clearly impossible to range the slopes of all the stamp mountains—a hurried count gives rather more than 50 peaks to be scaled—but among our selected few there is more than enough to reveal a new facet of our many-sided hobby.



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Stamp Gossip

and Notes on New Issues



British Guiana Pictorial Issue

A familiar feature—the three-masted sailing vessel—is missing from British Guiana's pictorial set issued in commemoration of the centenary of the union of the territories of Berbice, Demerara and Essequibo to form the colony of British Guiana. Only on one occasion previously, the Jubilee stamps of 1898, has the colony dispensed with the ship as a central feature of its stamp designs.



The new issue is a worthy production, however. It comprises five stamps, 1c., 2c., 4c., 6c. and $1, for which four designs are employed. The 1c. stamp shows a view of a native rice field. This stamp, it will be noted, features scrolls bearing the names of the three counties, but omits the King's head. In these respects the 6c. stamp is similar, but the main feature of its design is a view of the Public Administration buildings at Georgetown. The 2c. stamp has a very striking design, showing a native of the Wapisiana tribe on a fishing expedition. The menfolk of this tribe are great sportsmen, their lives being devoted to hunting and fishing, and they rarely use any other weapon than the bow and arrow.

The 4c. value, the design for which is also used for the $1 stamp, shows the beautiful Kaieteur Falls on the Potaro River. The size of these falls requires imagination to picture, for they are five times the height of Niagara and drop sheer for a distance twice the height of St. Paul's Cathedral!

In preparation for this issue the British Guiana authorities issued a special advertising post mark—" British Guiana Centenary Postage Stamps. To be issued 21st July, 1931. Cost per set of five: $1.13." This is a remarkable example of official publicity. No country other than one of unblemished philatelic record could have got away with so open an invitation to the stamp collecting world.

U.S. Red Cross Issue

The 2c. commemorative issued by the United States of America in celebration of the 50th anniversary of the foundation of the American Red Cross Society is probably the most attractive of the many recent U.S. special issues.

The design, strikingly carried out in black and scarlet, shows a nurse with ministering hands outstretched over a globe of the world.

Forthcoming Australian Issues

Some interesting figures of printings of Australian commemorative stamps are available this month, and reveal most strikingly the enormous popularity achieved by the issues.

Australia gives the figures for all special issues from 1928, commencing with the 3d. Kookaburra issued to celebrate the Philatelic Congress held at Melbourne. The figures are as follows:—

		Quantity Printed
1928.	3d. Kookaburra (in Exhibition Sheets) ...	2,000,000
	do. do. (do. full sheets)	3,000,000
1929.	W. Australian Centenary 1½d.	24,000,000
1930.	Sturt 1½d.	20,000,000
	Sturt 3d.	3,000,000
	2d. on 1½d. Provisional	4,000,000
	5d. on 4½d. do.	250,000
1931.	Kingsford-Smith 2d. ...	20,000,000
	do. 3d. ...	2,000,000
	do. 6d. ...	180,000

Since the official announcement of the quantities, several small additional printings of the Kingsford-Smith 6d. issue have been made, and the total quantity for this denomination is probably now about 250,000.



It will be apparent from these figures that buying popular commemorative issues for investment purposes is not a practical proposition, except among the high values, and the numbers of these issued are too large to make early increase in value possible.

It would be interesting to know the extent of the sales of these stamps for philatelic as distinct from purely postal purposes. The Australian Commonwealth Government in an official statement admit quite frankly that such sales help " in their small way " to balance the country's finances, and therefore they propose to produce a number of new issues. For instance, there are in preparation the new 6d. air stamps, coloured brown, referred to in our August issue. The design for this is substantially the same as for the Kingsford-Smith commemorative issue, but omits the special inscriptions.



A complete new general series also will be introduced as opportunity serves. The designs will feature chiefly Australia native fauna. A design for a Kookaburra stamp has been accepted already, and others showing the Lyrebird, the Kangaroo and the Platypus are in hand. The King's Head will be retained for the high values.

Gibbons' 1932 Catalogue

In the past we have emphasised on many occasions the extreme value of stamp catalogues to every class of stamp collector. At the risk of wearying our older readers, we must repeat our annual exhortation to the young collector to get hold of an up-to-date catalogue at all costs. Nine-tenths of the hobby's joys are missed if the



collector drifts along unguided. He might well be likened to a rudderless ship.

The newly-issued Gibbons' catalogue drives our argument home. It presents 2,000 pages of facts about the hobby; describes, illustrates and prices every variety of every stamp issued; offers suggestions for improving the quality of a collection; provides a recognised fair basis for selling, buying and exchanging stamps in any part of the world; and the " catalogueless " collector cheerfully ignores it all for the sake of saving ½d. per day!

The 1932 catalogue lacks nothing of the interest and value of its predecessors. Its bulk has increased to provide space to detail the many hundreds of new issues that have appeared in the past year, but of price movements there are few. Messrs. Gibbons explains that their purchases of the stocks of two leading firms of stamp dealers have enabled them to maintain unaltered the prices of many stamps that otherwise would have been marked up this year. The rarer issues have moved up again, of course, but except as curiosities the young collector is rarely concerned with these. In a very few cases, prices have been reduced.

In accordance with recent custom the catalogue appears in two sections: "British Empire " and " Rest of the World." These may be obtained from any stamp dealer, or direct from Messrs. Gibbons, 391, Strand, London, W.C.2, at 6/6 and 10/– respectively, postage extra (U.K. 5d. and 9d. respectively; Overseas 8d. and 1/– respectively). The combined sections, bound as one volume, are priced 15/–, plus postage (U.K. 9d.; Overseas 1/3).

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

The Best Pen at the Price!



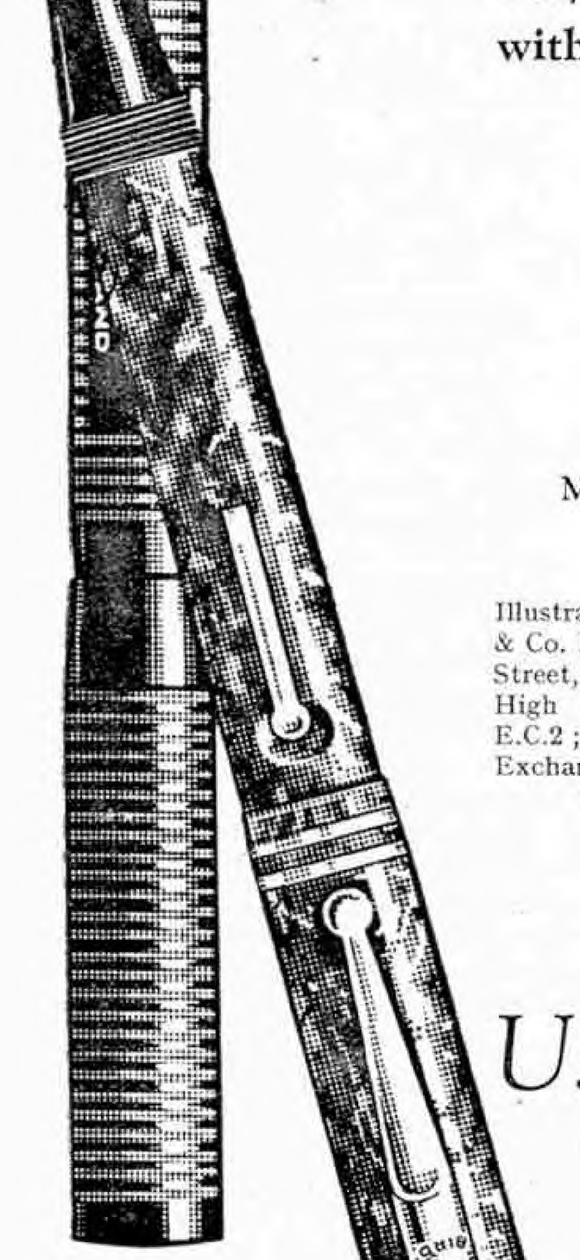
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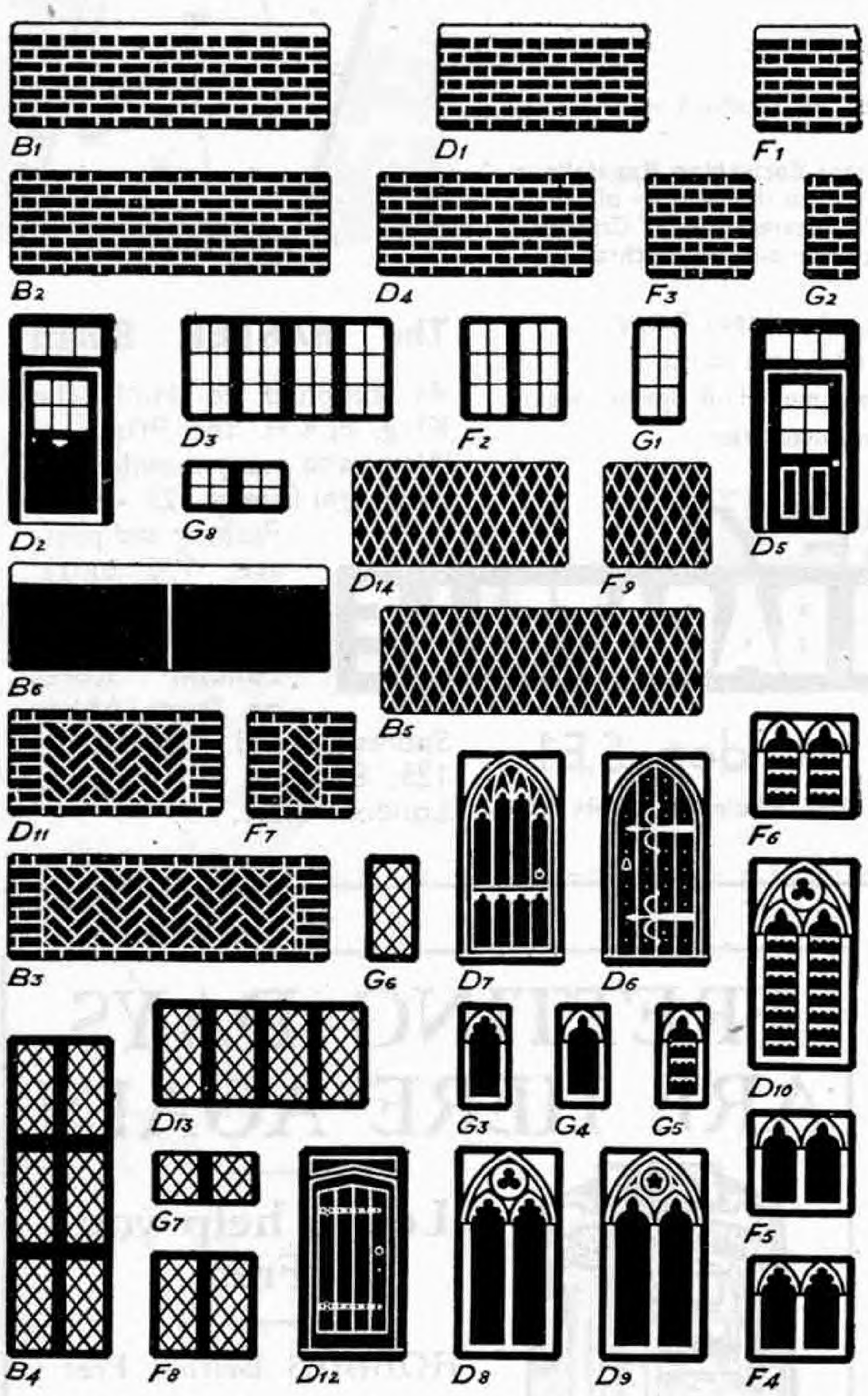
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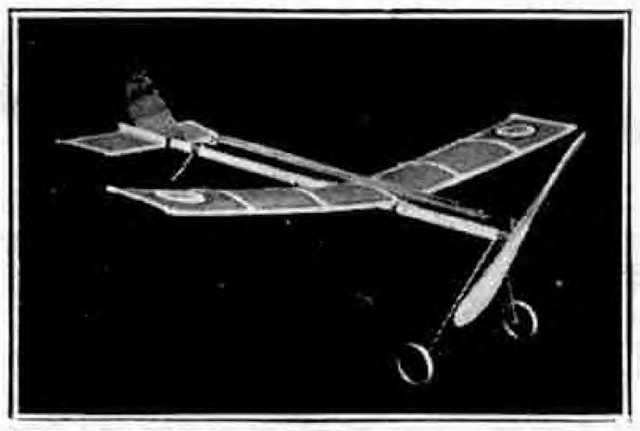
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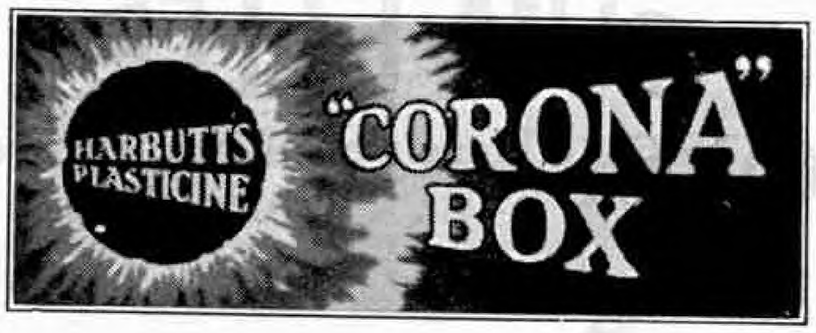
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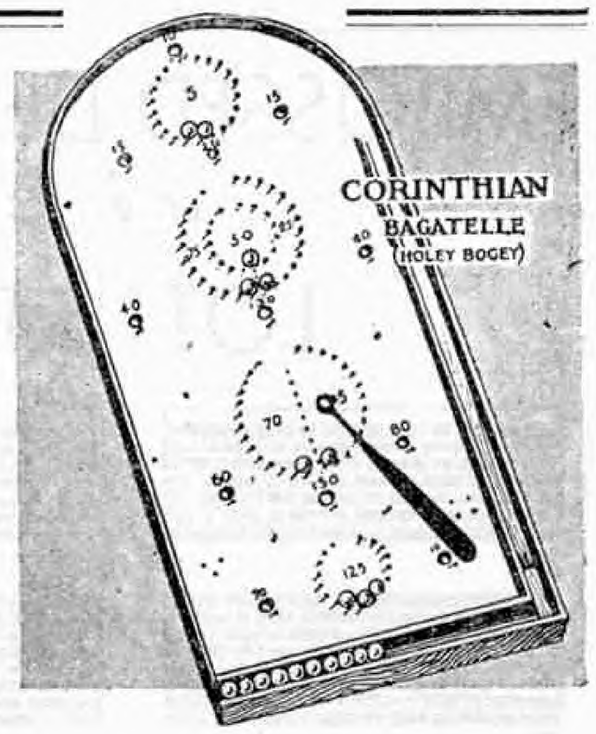
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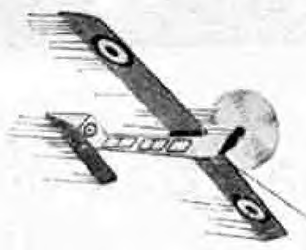
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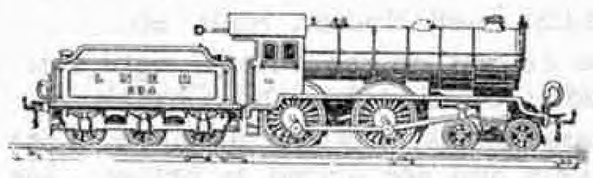
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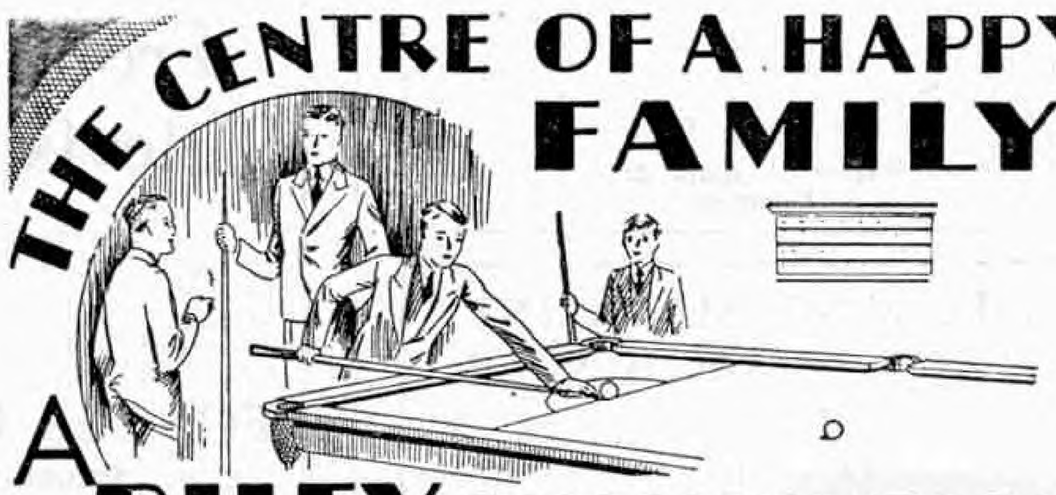
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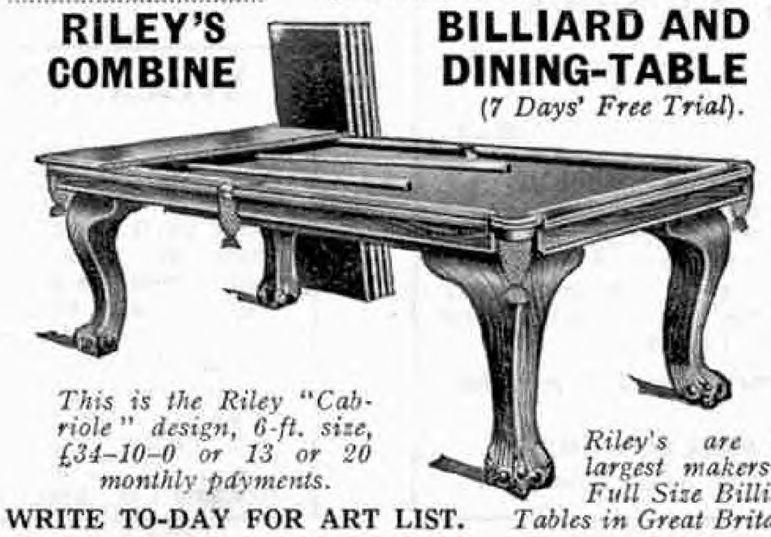
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FAMOUS TRAINS



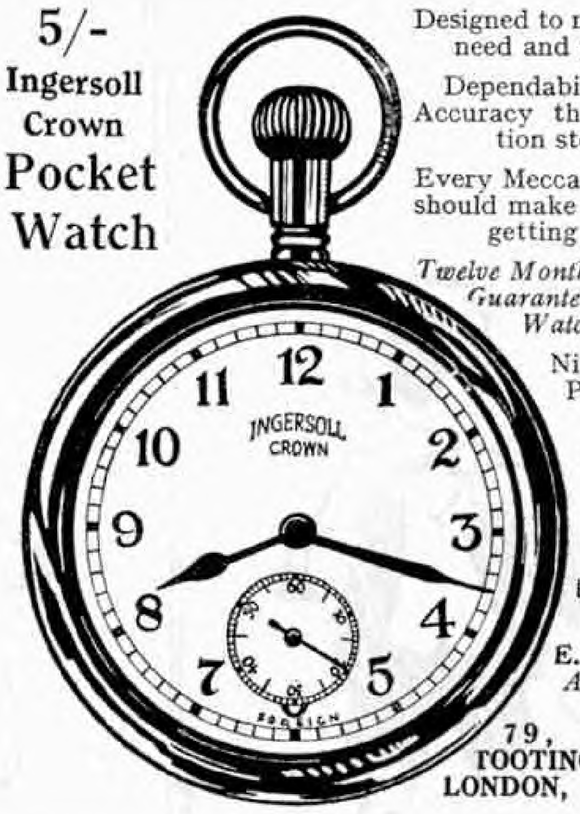
Thirteen chapters of Mr. C. J. Allen at his best!

All Railway enthusiasts should have this book. It contains much reliable and valuable Railway information, including the leading dimensions of many of the most famous express passenger locomotives in this country.

Price now 1/9 post free from

MECCANO LIMITED, Old Swan, Liverpool.

5/- Ingersoll Crown Pocket Watch



Designed to meet every need and pocket.

Dependability and Accuracy the foundation stone.

Every Meccano Reader should make a point of getting one.

Twelve Months' Written Guarantee with each Watch.

Nickel Case, Plain Dial, **5/6.**

Luminous Dial, **8/–.**

Send To-day.

Post Free.

To E.WISTOW, *Accredited Agent,* **79, UPPER TOOTING ROAD, LONDON, S.W.17.**

DEVIL AMONG THE TAILORS

NEARLY NOISELESS ! !



7/11 Post Free

Played by Young and Old

Size 18" × 13"

Polished mahogany colour. Bottom covered green baize cloth. Skittle table covered cork. Numbered. Best polished boxwood skittles and easy turning swivel. Satisfaction or money refunded.

Send P.O. for 7/11 to

TOPPING'S MAIL STORES, 73, BRAUNSTONE GATE, LEICESTER.

"From Crystal to Television" for 2/-

by V. Richards.
With a Foreword by J. L. Baird.

A simple account of all the processes and problems of wireless and television . . . . . It explains what actually happens in the set. Illustrated—Published (1928) at 5/–. Offered at 2/–. Post Free. On approval. Quote Offer 561.

FOYLES FOR BOOKS

NEW, SECOND-HAND, OUT-OF-PRINT

On all subjects

119-125, Charing Cross Road, London, W.C.2.



MAKE A GRAMOPHONE AT ¼ price. Double spring motor, 12 in. velvet turntable, swan arm, metal soundbox, horn, needle cups, for **£1-16s.-0d.** p. p. Portable Gramophones from **15/6,** postage **1/6.** Motors from **7/6.** Lists free. 64 pp. 1931 Catalogue No. 220, with Reduced Prices, drawing, and how to make Gramophones, **3d.** Established 27 years.
Regent Fittings Co., 78D, 120, Old Street, London, E.C.1.

MECCANO ENAMEL



Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red, grey or green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.

Price per tin 8d.

Meccano Ltd., Binns Road, Old Swan, Liverpool.

Model-Building Contest—(*Cont. from page 908*)

bridge is built on the cantilever principle, the trusses of the anchor arms and the cantilever being of the "K" type. In the model the trusses are 12½" in depth at the main piers, but narrow down to 3½" at the end of each anchor arm; at the centre the main span is 4½" in depth and measures 5 ft. 10 in. from centre to centre of the main piers. The length of each anchor arm is 2 ft. 1⅛ in.

Second Prize in the Home Section goes to L. Blowers for a good model of a counter-balanced lifting bridge. The roadway is raised by means of a Clockwork Motor, the weight of which is utilised to form part of the counter-balance.

In submitting his entry, Blowers went to the trouble of taking a photograph showing the model actually spanning a miniature river formed in the garden. The effect is splendid, and Blower is to be congratulated on his artistic abilities.

D. McLean won Third Prize with a model of a swing bridge. This comprises a main girder-built roadway that is pivotally supported on a roller race carried on a single central pier. The power unit is a Clockwork Motor and in operation the bridge can be swung round in a line with the river in order to allow ships to pass.

Lack of space prevents mention of the other prize-winning models, but many of them are so interesting that I intend to illustrate one or two of the best in future issues of the "*M.M.*"

An Opportunity for Dundee Meccano Boys

Messrs. Smith Bros., 3-5, Murraygate, Dundee, announce a Model-building Competition open to all boys who own Meccano Outfits. This is arranged on similar lines to the very successful contest organised last year. Entrants must be between the ages of seven and fifteen years, and they are divided into three separate classes according to age. Any number of models may be entered by each competitor, the only condition being that these must be his own unaided work. In awarding the prizes, the skill of the model-builder will be the chief consideration, but points will be awarded for originality, and the more original a model the better chance will it have of winning a prize. There is no restriction in regard to the number of parts that may be employed, but a special class has been arranged for competitors who do not use more than a certain number.

Finished models entered in the Competition must reach Smith Bros. on the 2nd and 3rd December, and no entries arriving after the 3rd will be accepted. Judging will take place on 5th December. A special entry form is provided and this, together with full particulars of the Competition, may be obtained post free on application to Messrs. Smith Bros. at the address given.

Home Billiards for Winter Evenings

The long winter evenings bring with them the problem of providing interesting indoor amusement. One of the happiest solutions to this problem is supplied by billiards, which combines excitement and interest to a greater extent than any other indoor game, and can be played night after night without ever becoming monotonous. A full-sized table cannot be accommodated in an ordinary room, but all the fun of the game may be obtained on the small tables specially designed and built by Rileys of Accrington, whose name is known wherever billiards is played.

The most popular model made by this firm is undoubtedly the 6 ft. table, which rests comfortably on an ordinary dining table. A splendid game may be played on this, and it affords excellent practice for subsequent play on a standard table. There are many other sizes of table, however, both larger and smaller, including a splendid combination table which serves the two-fold purpose of a dining table and a perfect billiards table, being convertible to either purpose in a few seconds by means of a simple automatic lifting device. Some details of these tables will be found in the firm's advertisement on page 937.

Price lists of these splendid tables may be had free on application to E. J. Riley Ltd., Deal Works, Accrington; or from their London Showrooms, Department U, 147, Aldersgate Street, London, E.C.1.

A New Transformer

Since publishing the 1931 price list we have introduced a new 6-volt Transformer, the price of which is 22/6. This new Transformer is available for all standard voltages, from 100 to 250 inclusive, at all standard frequencies from 50 cycles upwards. Will boys who have already obtained copies of the new Hornby Train price list note the necessary alteration on page 13.

Hornby Part Exchange Scheme

The Hornby Locomotive Part Exchange Scheme will temporarily cease to operate after the 12th December 1931, but it will be resumed on the 1st January 1932. Boys who wish to take advantage of this "New Locomotives for Old" offer before Christmas should make a special note that exchanges must be effected prior to the 12th December.

HORNBY SERIES

HORNBY ACCESSORIES

HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

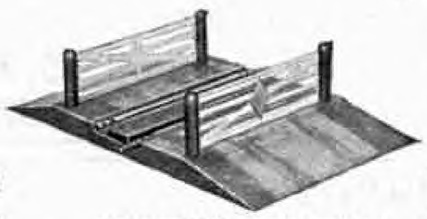
A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



DOUBLE ARM SIGNALS No. 1
Price **4/3** per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated).
Price **3/–** each.



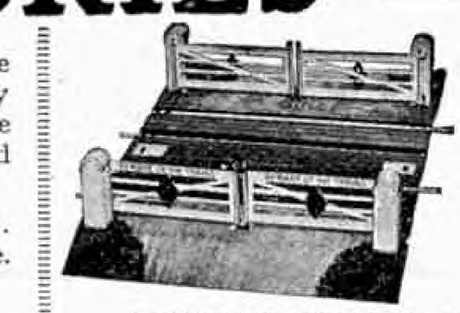
OIL CAN No. 2 ("K" Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price **3/6**



M LEVEL CROSSING
Suitable for a single track, with Gauge 0 rails in position.
Price **1/6**

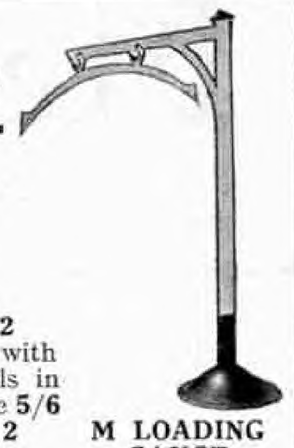


M STATION SET; 7 pieces
Price complete **3/-**
The components of the M Station Set may be purchased separately as follows:—M Wayside Station. Price, each, **10d.**
M Signal Box ... Price, each, **4d.** M Signals ... Price, each, **4d.**
M Station ... Price, each, **1/-** M Telegraph Pole No. 1 Price, each, **3d.**
M TELEGRAPH POLE No. 2. Price **6d.** each.



LEVEL CROSSING No. 2
Measures $13\frac{1}{2} \times 10\frac{1}{4}$ ins., with two tracks of gauge 0 rails in position ... ... Price **5/6**

LEVEL CROSSING No. 2 (Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price **8/–**

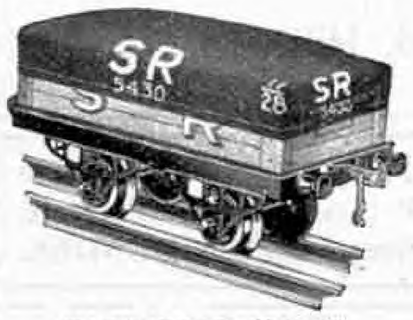


M LOADING GAUGE
(Illustrated)
Price **1/–**
LOADING GAUGE
Price **2/3**





TUNNEL
Realistic and finished in colours ... Price **5/9**



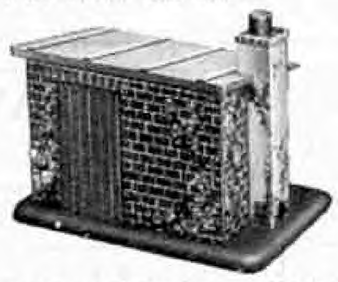
TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price **3d.**



TURNTABLE No. 2
Price **4/6**
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price **8/6**



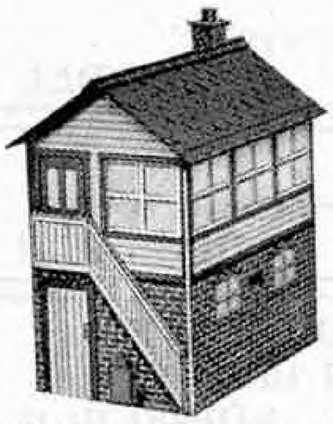
MODELLED MINIATURES No. 1 STATION STAFF
These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. Price **2/-** per set.



PLATELAYER'S HUT
Price ... **2/6**



FOOTBRIDGES
No. 1, without signals. Price **4/–**
No. 1a, with detachable tin-printed signal posts and arms ... Price **4/9**
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price **7/6**
Signals only, for No. 2 footbridge. Price ... ... per pair **3/9**



SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width $4\frac{1}{2}$ ins. Length 6 ins. Finished in colours ... Price **2/9**



LAMP STANDARD No. 1 (Single) Electrical
(Illustrated above)
Price **3/6**
LAMP STANDARD No. 2 (Double) Electrical
Price **4/3**



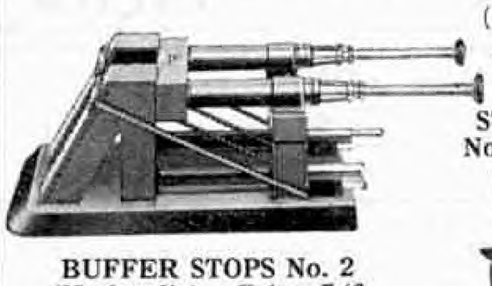
GOODS PLATFORM
Length $16\frac{3}{4}$ ins. Height $6\frac{3}{4}$ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**



JUNCTION SIGNAL
"Home" or "Distant" Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height.
Price **6/–**

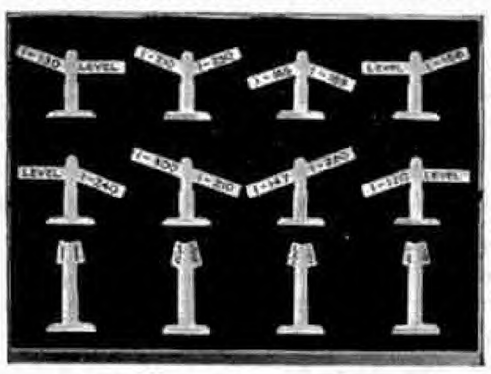


HOARDING, STATION
This is a realistic accessory, suitable for the station platform. Brightly coloured.
Price **8d.**

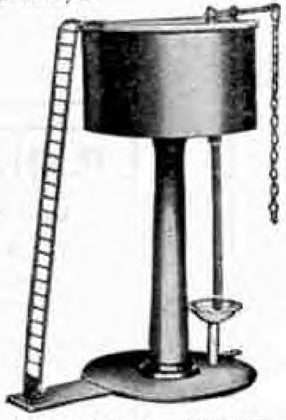


BUFFER STOPS No. 2
(Hydraulic) Price **5/6**

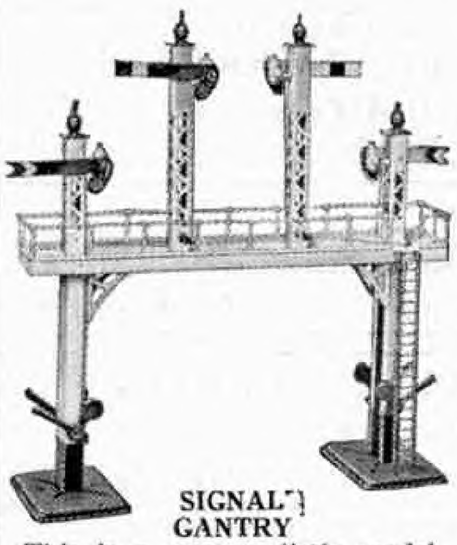
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price **2/–**



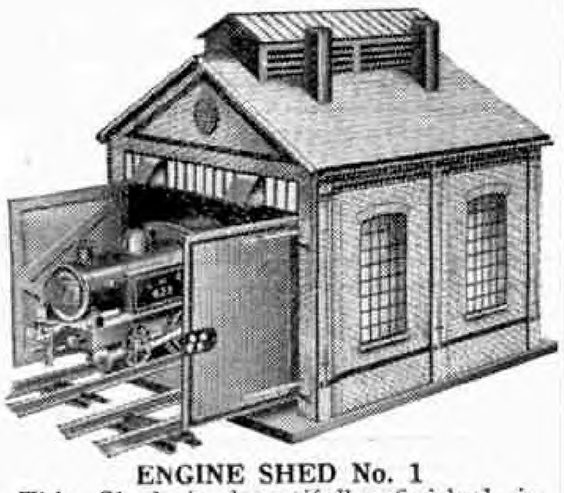
WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever.
Price **8/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/–**



RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**



ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price **15/–**

VIADUCT. Price **7/–.** Centre Section only. Price **4/9**
ELECTRICAL VIADUCT. Price **8/–**
Centre Section for Electrical Viaduct. Price **5/3**

TUNNEL ENDS
These Tunnel Ends add realism to Tunnels made of cardboard, or other suitable material. They may be fitted into position quite easily.
Price, per pair, **2/9**

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this and the opposite page carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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Model Makers to the Admiralty, Railway Coys., etc.

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Estab. in 1840 PECKHAM, S.E.15.

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Continued from previous page

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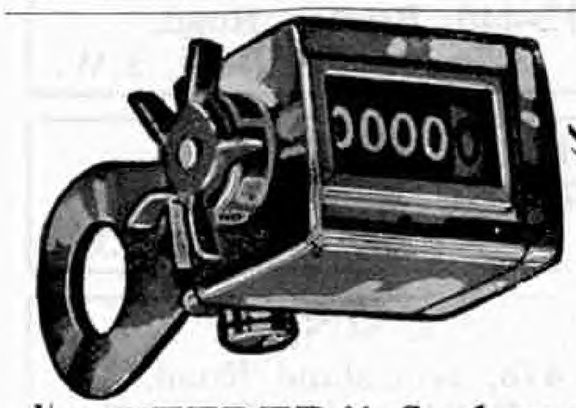
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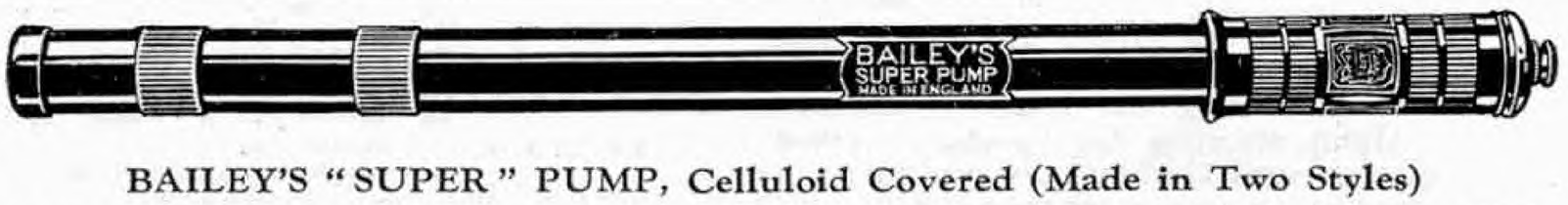
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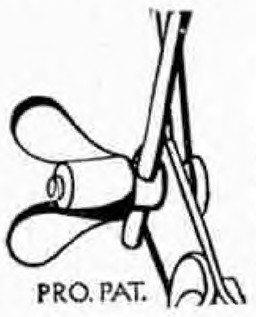
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This Month's Special Articles

	Page
Air News	884
Behind the Scenes with a Railway Chef	880
Breakdown Cranes in Meccano	899
Breakdown Trains and Their Work	858
Books to Read	894
Competition Page	925
Cornish China Clay Industry	872
Development of Steel Rails	879
Earthquake Scenes in New Zealand	862
Engineering in Ancient Egypt	866
Engineering News	864
From Our Readers	890
Fireside Fun	927
Gramophone News	893
Guild Pages	910–11
Hornby Railway Company Pages	913–923
In Reply—Meccano Section	907
£500 Model-building Competition	898
Meccano Aeroplane Constructor Outfits	888
Meccano Six-Inch Howitzer	900
Model-building Contests Results	908
Modern Types of Helicopters	886
New Meccano Models	896
Our Wonderful World	870
Railway News	874
Rounding Up Canada's Buffalo Herd	868
Some Members of the Locomotive Family	876
Stamp Collecting	929
Stamp Gossip	931
Suggestions Section	905
The Fastest Train in the World	882
"What Shall I Be?"	860

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Junior Section—(*Continued from page 917*)

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EDITORIAL AND ADVERTISING OFFICE:—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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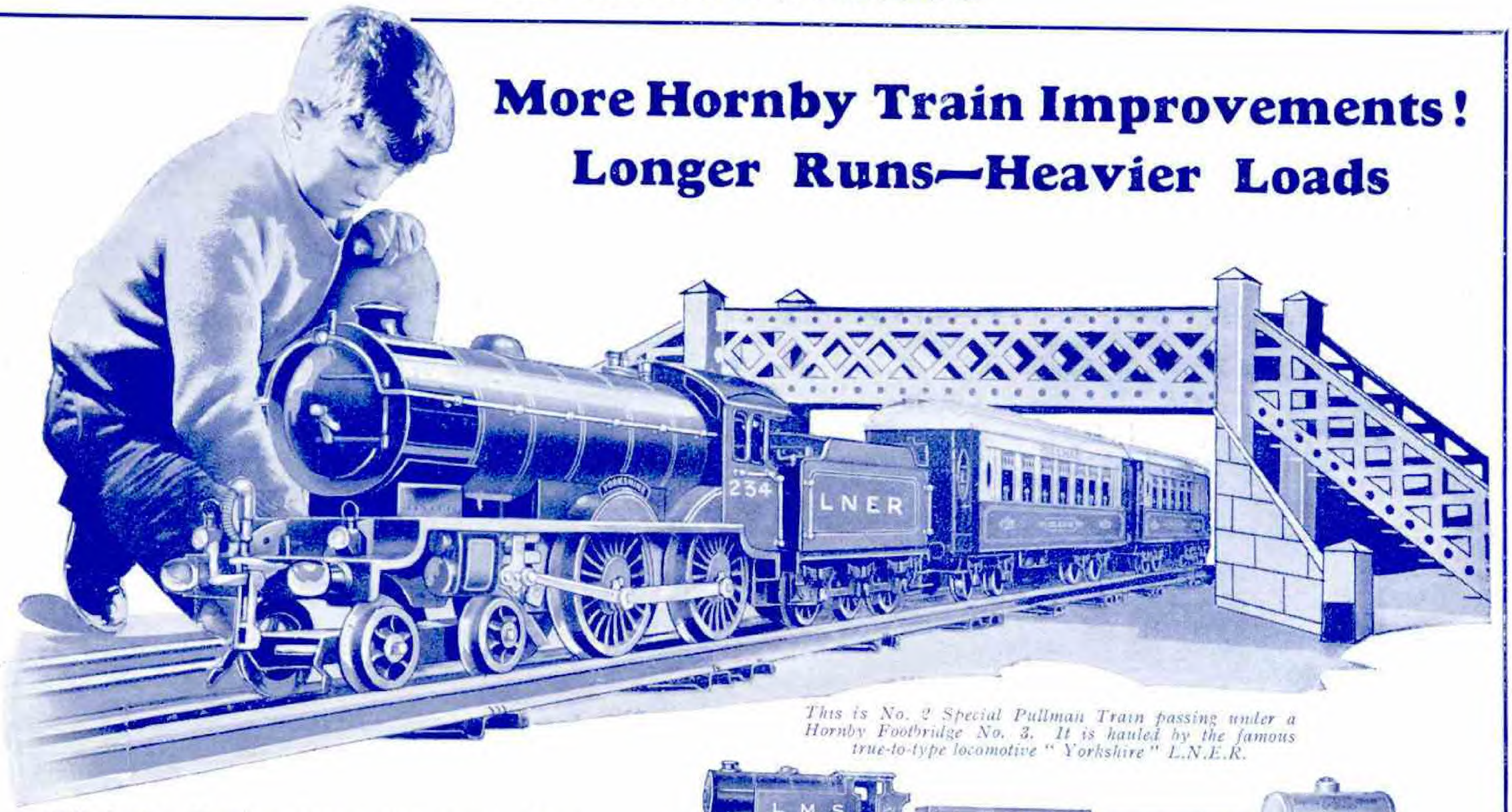
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Old Swan, Liverpool



Aeroplane Construction Outfit No. 2

PUBLISHED BY MECCANO LTD., OLD SWAN, LIVERPOOL, ENGLAND.
Printed by John Waddington Ltd., Leeds and London.